Engineering Response to AirCell's Reply Comments

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1 Introduction & Background

This report has been prepared by V-COMM, L.L.C., a full service engineering and consulting firm fulfilling the needs of the wireless telecommunications industry since 1996. Biographies of key individuals contributing to the report as well as an overall profile of V-COMM, L.L.C., are included in the Appendix Section 10.1 of this document.

V-COMM has prepared this report in response to the Reply Comments of AirCell, Inc. ("Reply") submitted by AirCell on June 9, 2003 to the FCC regarding its requests for waiver extension. The AirCell Reply document includes the "AirCell Engineering Review of V-COMM Reports" document ("Engineering Report") as Exhibit B of its submission, regarding the compatibility testing and engineering reports provided by V-COMM ("V-COMM Engineering Reports"), which were submitted to the FCC on April 10, 2003. The AirCell Reply also includes comments regarding its flight tests from its 1997 report, and its cross interference tests as submitted to the FCC on March 28, 2002, within AirCell's petition for waiver extension. V-COMM responds to these statements provided by AirCell in this document.

The V-COMM Engineering Reports were submitted to the FCC on April 10, 2003, as attachments to Opposing Carriers' filings.[1] The documents included the following:

- Engineering Report of the AirCell Compatibility Test (includes the AirCell Compatibility Test Plan and the AMPS Noise Floor Study)
- Engineering Response to AirCell's Petition for Waiver Extension
- Engineering Analysis of the FCC Order on Remand

Within the "Engineering Report of the AirCell Compatibility Test" ("V-COMM Test Report"), V-COMM provides test results and analysis of comprehensive compatibility tests. Included in these test results are flight tests with many flight patterns, cross interference tests with CDMA, TDMA and AMPS terrestrial cell sites using actual market conditions, and a case study analysis showing the effects of harmful interference to the terrestrial cellular networks. Within the appendices of the V-COMM Engineering Report, the AirCell Compatibility Test Plan and the AMPS Noise Floor Study documents are provided.

Within the "AirCell Compatibility Test Plan" document, V-COMM provided detailed descriptions of test plans and procedures utilized in V-COMM's AirCell system compatibility and interference testing. Prior to performing these compatibility tests within market, V-COMM forwarded the proposed compatibility test plan to AirCell and encouraged AirCell to participate in joint testing with V-COMM and the carriers. AirCell did not accept this invitation to join this testing effort, however it agreed to verify the

[1] The "V-COMM Engineering Reports" were submitted as Exhibits to AT&T Wireless, Inc., Cingular Wireless LLC, and Verizon Wireless Comments in Opposition to Extension of Waiver, AirCell, Inc., Docket 02-86 (filed April 10, 2003).

AirCell mobile phones and AirCell base station equipment utilized in tests meets AirCell standards. In addition, V-COMM presented the proposed compatibility test plan outline to the FCC at an *ex parte* meeting in the FCC offices in Washington, DC on April 4, 2000.

Within the "AMPS Noise Floor Study" report, V-COMM provided test results of the operating noise floor levels as measured at eighteen terrestrial cell sites within various market type environments classified as dense urban, urban, suburban and rural.[2] These measurements were performed by V-COMM in the cellular B-band network within the New Jersey and Philadelphia, Pennsylvania market areas.

Within the "Engineering Response to AirCell's Petition for Waiver Extension", V-COMM examines the findings and conclusions of the AirCell/WSE compatibility and interference tests, and provides additional explanations pertaining to the compatibility of the AirCell system.

Within the "Engineering Analysis of the FCC Order on Remand ", V-COMM provides an engineering analysis of the technical issues and statements made within the FCC's Order on Remand with regards to the AirCell waiver.[3] In this Order, the Wireless Telecommunications Bureau affirms its granting of AirCell and its cellular licensee partners waivers of section 22.925 of the Commission's rules.

Through significant and comprehensive compatibility testing, V-COMM has gained specific knowledge of the compatibility issues associated with the AirCell system and its impact to the terrestrial cellular system. In a cooperative effort with interested parties, V-COMM has conducted extensive compatibility and interference tests within the AT&T Wireless, Cingular Wireless, and Verizon Wireless networks, as part of this proceeding. V-COMM is serving as an expert third-party engineering firm in evaluating these system compatibility issues, and is retained by a consortium of cellular companies composed of AT&T Wireless, Cingular Wireless, and Verizon Wireless.

[2] The results of the operating noise floor measurements for the eighteen cell sites range from –119 dBm to –127 dBm, with an average of –126 dBm. Based on these results, "toll quality" AMPS calls can maintain service on these cell sites at very low levels. The minimum "toll quality" call signal level with 17 dB C/I, is –102 to –110 dBm, with an average of –109 dBm. The results of the day-time noise floor field tests range from –118 dBm to –128 dBm, with an average of –125 dBm.

[3] The FCC Remand on Order (FCC 02-234) was released on Feb. 10, 2003, in the matter of the AirCell Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule.

2 Overview of Engineering Response

Within its Reply document, AirCell raised numerous issues concerning the validity of the compatibility and interference testing conducted by V-COMM in cooperation with Lucent Technologies and participating cellular operators. In this document, V-COMM responds to these statements and provides explanations that dismiss these claims. Also, in its Reply, AirCell raises a number of assertions directed toward Cingular and Lucent Technologies, which are unfounded and are addressed in this document, as well.

Overall, AirCell claimed that the V-COMM tests are flawed, measurements and site configurations were flawed, test data post processing flawed, and the resultant data interpretation was flawed. In this report, V-COMM provides detailed explanations to address the many unfounded claims, inaccurate statements, and flawed technical analyses provided by AirCell. In this report, V-COMM demonstrates that AirCell's inaccurate and unfounded statements stem from a number of problems and issues. These include flawed technical analyses, incorrect assumptions, misunderstandings of the operation of practical wireless systems, misunderstandings of digital wireless technologies, misinterpreting data and statements from other sources, misapplying values arbitrarily, and misguided efforts to discredit the opposing carrier's independent compatibility tests and conclusions, which provide clear and substantial evidence that the AirCell system causes harmful interference to the terrestrial cellular networks.

In this report, V-COMM provides the following report sections that address the issues raised by AirCell in its Reply Comments filing.

Section 3 addresses AirCell's assertions concerning the measurements and results of the AMPS Noise Floor Study. The AMPS noise study was performed by V-COMM for 18 typical terrestrial cell sites within the Philadelphia, PA and NJ market areas. AirCell's analyses are flawed and include misinterpreted statements from an old AT&T manual, invalid re-casting and removing of actual measurement data, misunderstandings of the operation of practical wireless systems, and inaccurate knowledge of typical base station equipment.

Section 4 addresses AirCell's assertions concerning the flight route, site configuration and results of V-COMM's AirCell Compatibility Flight Tests. These flight tests were utilized to characterize AirCell system compatibility to the terrestrial networks. AirCell's criticisms are inaccurate statements relating to V-COMM's flight tests. Contrary to AirCell's claims, the flight patterns utilized were representative of typical flight routes, the Marlboro AirCell base site's receive antennas were not obstructed by trees, the AirCell site was operating and configured according to AirCell standards, new sites that AirCell placed into service recently would not have had a significant impact to the results, and the measurements at the Oak Hill site do not defy free space propagation; they are misinterpreted by AirCell.

Section 5 addresses AirCell's assertions concerning the test plan and results of V-COMM's Phase 2 System Compatibility Interference Tests with AMPS, TDMA and CDMA technology. These interference tests were performed at a typical suburban terrestrial cell site, which was configured and operating normally, and were utilized to characterize the impact of the AirCell system interference levels to the terrestrial networks. AirCell's claims are inaccurate as described herein. The site's operating signal level settings were configured within the nominal vendor recommended ranges, and not 10 to 15 dB abnormally lower as claimed by AirCell.

Section 6 addresses AirCell's assertions concerning the interference assessments of the case study flight profile provided by V-COMM. The case study models the effects of interference from airborne subscribers to terrestrial subscribers by using the controlled test data from its flight tests and cross-interference tests to accurately depict the potential extent of interference that can be expected from airborne AirCell units. This is a valid model and a sound approach to depict the true effects of harmful interference from the AirCell system. AirCell's criticisms of the case study are for the most part repeated statements from its review of the Phase 1 flight tests and Phase 2 interference tests, and are addressed herein.

Section 7 addresses the additional information provided by AirCell, which attempts to reaffirm its 1997 flight tests and compatibility interference tests with TDMA & CDMA technology. AirCell provides very little new information, does not provide sufficient details to evaluate its test results, and provides other inaccurate statements with regards to terrestrial site noise floor levels and future digital technologies.

Section 8 addresses AirCell's criticisms of statements made by Lucent Technologies. AirCell misinterprets and misunderstands statements made by Lucent Technologies several times within its Reply. AirCell also offers inconsistent statements concerning the noise levels in the AMPS Noise Floor Study, underestimates the interference from narrow-band interference and misunderstands CDMA digital technology, and inappropriately questions the credibility of Lucent Technologies.

Section 9 includes an analysis of the Interference Effects of Illegal Airborne Cellular Telephone Calls and makes a comparison to the operation and interference effects of the AirCell system. With effective radiated power levels from mobiles served by base stations up to 90 miles away or more, antenna gain and line-of-sight propagation characteristics, the AirCell transmissions offer little protection as compared to standard cellular telephones used illegally in-flight.

Appendix Section 10 includes Section 10.1 V-COMM Background Information, Section 10.2 Cingular's Response to AirCell's Criticisms of Cingular, and Section 10.3 Case Study Flight Profile & Affected Terrestrial Sites, for the slant-45 polarized terrestrial cellular base station antenna. Cingular's response is attached as a separate document provided by Cingular, and it includes a figure depicting the AirCell antennas at the Marlboro site, as performed by an independent contractor. Contrary to AirCell's claims, this figure demonstrates that the Marlboro AirCell site's receive antennas were mounted "upright" (and not "inverted"), and were not obstructed by trees.

Overall, after reviewing the collection of flawed technical statements, misconceptions, and misinterpretations provided by AirCell in its Reply regarding the tests and findings of the V-COMM Engineering Reports, it can be concluded that AirCell's assertions are inaccurate and invalid. Consequently, in consideration of the substantial evidence provided by the opposing carriers' independently conducted tests, which clearly demonstrates that the AirCell system causes harmful interference to the terrestrial cellular networks, the Commission should re-assess its original position on the compatibility of the AirCell system.

This substantial evidence is based upon valid and representative empirical tests, measurement data, conclusions and analyses provided in the V-COMM Engineering Reports, which include signal level measurements, noise floor measurements, flight test measurements, and cross-technology interference compatibility test measurements. The empirical tests and findings include: a variety of flight patterns, altitudes and distances to serving and victim sites; both of AirCell mobile antennas; horizontal, slant 45 degree and vertically polarized terrestrial base station antennas; CDMA, TDMA & AMPS wireless technology compatibility tests; a comprehensive study of terrestrial noise floor levels, and a case study depicting the interference effects of AirCell airborne transmissions on a typical flight from Washington, DC to the New York metro area.

The results of these empirical tests indicated that "harmful interference" occurs from airborne AirCell transmissions to the terrestrial cellular networks. The AirCell signals received at terrestrial sites from flight tests were measured as high as -72 dBm, with many signals falling in the -90 dBm to -100 dBm range. Interference compatibility tests indicated a significant increase in adverse terrestrial performance with metrics such as dropped calls, blocked calls, MOS (audio quality), and reduced system capacity. Results of the Case Study indicate that as few as 200 and as many as 1500 terrestrial cell sites can be adversely affected by a single typical flight (from Washington, D.C. to the New York metro area).[4] The effects of harmful interference from airborne AirCell transmissions include serious obstructions, degradations in call quality, and repeated call interruptions to the terrestrial cellular analog and digital networks.

[4] An example from the Case Study is reproduced in Figure 10-A in Appendix Section 10.3. As observed from the figure, the range of affected terrestrial cellular sites is quite large. As highlighted in the Case Study, a significant volume of terrestrial calls can be adversely affected by just one AirCell call, on just one channel, on just one flight. Since multiple AirCell calls on multiple channels are possible and in fact likely when considering the volume of flights and passengers in this area, an even greater number of affected terrestrial cell sites can be expected to experience harmful interference. Likewise, when considering the number of flights occurring across the country, the daily number of terrestrial cellular calls affected by AirCell operations would be very significant. Finally, when considering that terrestrial wireless phones generate 35% to 50% of all 911 & emergency calls, the impact to the general public becomes extraordinary.

3 AMPS Noise Floor Study

Within its Reply, AirCell provided several criticisms of the test procedures and results of the AMPS Noise Floor Study. The AMPS Noise Floor Study was performed by V-COMM and provided measurements of the operating noise floor level over a 24-hour period for 18 typical terrestrial cell sites within the Philadelphia, PA and NJ market areas. These criticisms are addressed below and are unfounded and inaccurate statements relating to the AMPS noise floor tests conducted in cooperation with participating carriers and with the supervision of Lucent Technologies, the manufacturer of base station equipment utilized in this market.

AirCell's assertions in its Reply and Engineering Report regarding the AMPS Noise Floor Study are summarized below:

1. The lower three bins of non-zero measurement data should have been thrown out, per a quotation provided by AirCell from the equipment vendor's documentation. AirCell also calculates the system noise floor of the cell site in support of this position.
2. The AMPS noise floor measurements require re-casting to represent the higher interference levels, and the noise levels during quieter times of the day should not be considered. Carrier's operating signal level needs to be 17 dB above the highest peak noise floor level from the noise floor levels re-cast by AirCell. 100% of all calls must maintain this margin 100% of the time.
3. Noise floor data re-cast by AirCell, and signal level data shifted-up by AirCell, shows supportive material regarding the FCC's –100 dBm minimum call level, as used by the FCC in its Order on Remand.
4. The Lucent Power Level Measurement (PLM) function skews the measurement data with significantly more samples collected during the night time period.
5. Cell site receiver calibration tests should have been performed with both receive antennas disconnected.
6. Cell site receiver calibration tests should have been performed with signal generator connected to the cell site's coupler input port.
7. Cell site receiver calibration tests should have been performed on both of the cell site receive diversity paths.
8. More accurate test equipment should be utilized to perform noise floor measurements instead of using the cell site receiver for these measurements.
9. The eighteen cell sites and channels selected may be atypically lower than the normal cell sites in the surrounding market areas.

These assertions are provided within section 2.2 of AirCell's "Engineering Review of V-COMM Reports" document, which contains 67 pages of analyses and statements representing approximately one-third of its engineering review document.

These assertions are addressed below and should be dismissed as unfounded and inaccurate statements relating to the AMPS noise floor tests.

AirCell Assertion:

1. The lower three bins of non-zero measurement data should have been thrown out, per a quotation provided by AirCell from the equipment vendor's documentation. AirCell also calculates the system noise floor of the cell site in support of this position.

This is one of AirCell's major issues regarding the AMPS Noise Floor Study. AirCell asserts that the lowest three bins of non-zero measurement data must be thrown out according to a quotation provided by AirCell from an outdated AT&T Autoplex document.[5] AirCell also calculates the cell site equipment's system noise floor, as referenced to the cell site antenna, in attempts to support this position. This is AirCell's justification to selectively manipulate (AirCell refers to this as "re-casting") the actual noise floor levels measured and occurring at the 18 AMPS cell sites.

In its Engineering Report, AirCell claims that V-COMM did not follow Lucent's recommendations for post-processing PLM data[6] (by not 'throwing out' the lowest non-zero bins of data). AirCell's claim is not correct. Lucent was an active party to the testing, providing insight after reviewing the test plans, tests, and processing of data, as Lucent indicated in its comments submitted to the Commission (filed on 4/10/03). As such, V-COMM received input directly from Lucent's subject matter experts on the testing and post-processing methods. In addition, Lucent Technologies' subject matter experts reviewed AirCell's Reply Comments regarding the referenced quote from the old AT&T manual, and provided the following feedback. Lucent's PLM subject matter experts state they neither recommend, nor agree with the removal of the lowest bins of non-zero data. Further, Lucent provided the following statement in its recently filed comments submitted to the Commission:[7]

> *"V-COMM did, in fact, consult with Lucent regarding the method of processing PLM data. AirCell argues that some readings at the lower end of the measurement range should be discarded, evidently basing this objection upon a statement within an old AT&T Corp. manual that points out the lowest values obtained represent noise rather than interference. As V-COMM's purpose was to obtain a baseline of total impairment (i.e., thermal noise plus other sources of cochannel interference), the retention of these values was appropriate. The statement from the AT&T manual is taken out of context, and does not apply to V-COMM's intended use of the data."*

[5] AT&T was the predecessor of Lucent Technologies, prior to the AT&T company split in 1996. Also, it is important to note that the current documentation provided for the Lucent cell site equipment does not contain the language quoted by AirCell.

[6] PLM is a Lucent cell site feature that logs received power over time. The PLM mode 2 cell site feature logs received power over time, while a voice channel is idle (not actively serving calls).

[7] Lucent's statement "Ex Parte Further Comments of Lucent Technologies, Inc." (Lucent's Further Comments) is recently filed in this proceeding, on 10/9/03.

Consequently, Lucent confirms that the referenced quote from the older AT&T manual is taken out of context. The lower bins of the PLM mode 2 data are the measured interference plus noise floor levels, just as the higher bins of data are also the measured interference plus noise floor levels that occurred during the measurement period. Cell sites having low operating noise levels will have their interference plus noise levels at or near the equipment's noise floor level. Co-channel and adjacent channel interference is being measured on the channel during the entire period. Due to the engineering and optimization of the cellular network, the interference plus noise floor conditions were very quiet. Consequently, the cellular AMPS spectrum can be fully utilized and the networks can offer improved coverage, capacity and quality of its service to its subscribers.

In addition, it should be noted that the post-processed PLM data and histograms (i.e. carrier to interference histograms) must include *all* measurement data bins to be accurate. It is not valid to selectively remove portions of *actual* measurements, then compute composite carrier to interference ratios.

Therefore, Lucent's subject matter experts *do not* agree with AirCell's assertions and their justification for re-casting the noise floor measurements, represented by the PLM data. The quotation referenced by AirCell is taken out of context and does not have any validity regarding the noise floor measurements provided in the AMPS Noise Floor Study. Consequently, the re-cast noise floor graphs provided by AirCell are invalid.

AirCell uses a similar approach to justify the noise floor levels used in its Cross Interference Tests with TDMA & CDMA technology.[8] Statements from Lucent's subject matter experts are also in disagreement with these statements of AirCell as well. Consequently, AirCell's attempts to support the noise floor levels used in its Cross-Interference tests are also not supported by this reference.

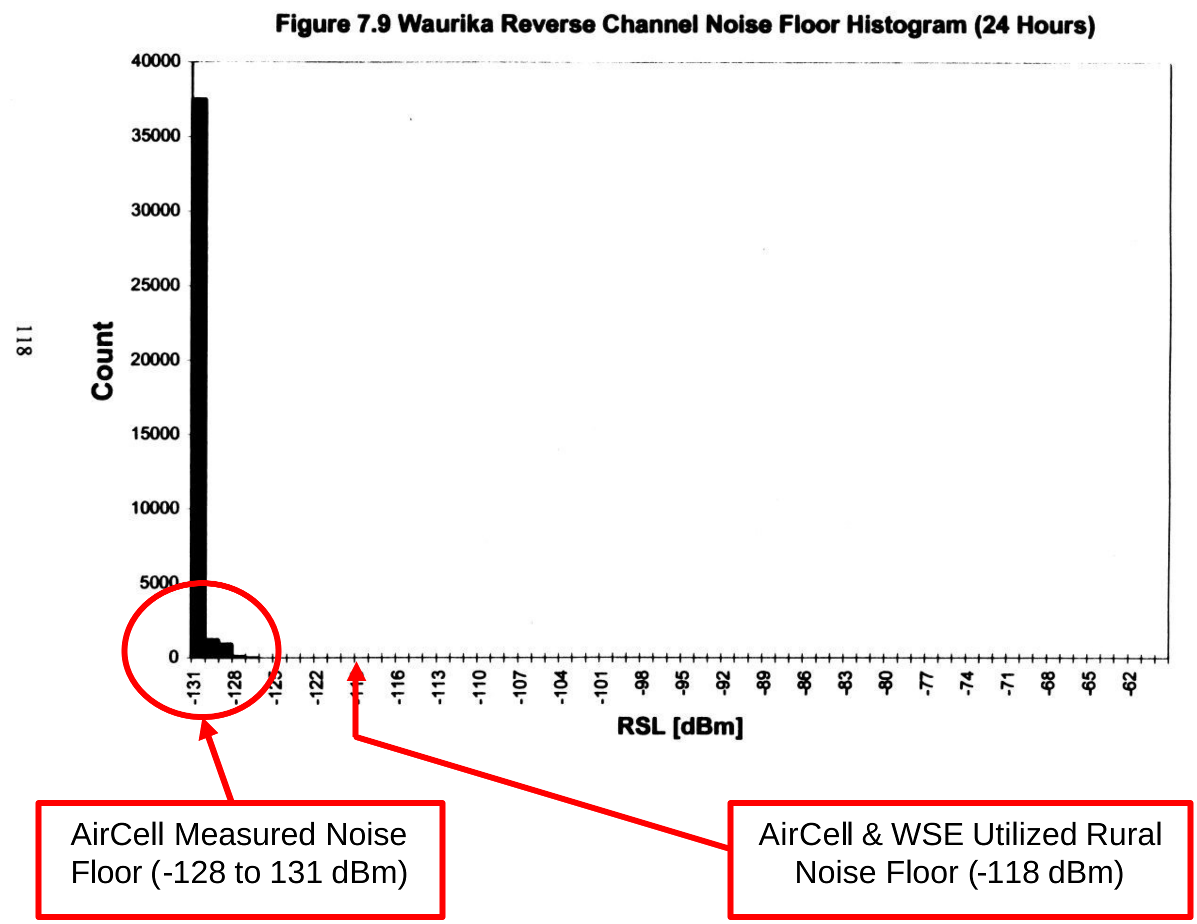
Furthermore, it should be noted that AirCell's position does not make sense. There is no reason to selectively remove just the lowest noise floor levels, and only show the highest noise floor levels. *All* the measurements are actual noise floor conditions occurring at the site, not just the highest measurements. And, most of the time the measurements show that the cell site operating noise floor conditions are very low, which allows calls to be maintained on the cellular networks at similarly low levels. Excluding the time periods with low noise floor conditions would remove almost all of the measurements. The noise floor measurements were conducted over a 24-hour period to show the distribution of noise floor conditions that exists in these market areas. AirCell's re-casting efforts are nothing more than an attempt to hide the actual lower noise floor conditions that exist for these typical terrestrial cell sites.

[8] AirCell arbitrarily injected much higher noise floor levels than actually exists at the cell site during its cross-interference tests, which masked any interference effects that would have occurred. In addition, AirCell removed the antennas and the cell site from service, creating a laboratory and static environment for its cross interference tests. Thus, its results are unrepresentative of the actual operating environment that exists for cell sites.

It appears AirCell's motivation to support this position was a result of its desire to show a disproportionately higher noise floor level than actually exists, thereby making a better showing when comparing to the additional interference from the AirCell system, and to support the higher noise floor levels used in its Cross-Interference tests.

It should also be noted that AirCell is being inconsistent and disingenuous with these new claims. AirCell did not remove the lowest noise floor bin measurements in its previous noise floor measurements submitted into the FCC record. For example, the empirical data provided by AirCell in its 1997 report exemplifies similar results to the V-COMM noise floor study. In AirCell's data, the terrestrial noise floor levels are in the range of -131 to -128 dBm, with approximately 95% of the readings at -131 dBm. These terrestrial noise floor levels are for the Waurika site, and are reproduced in Figure 3-A below. Thus, AirCell's own claims in its most recent filing are not supported by their own measurement data presented in its 1997 filing.

Figure 3-A AirCell Measured Terrestrial Noise Floor Levels (From AirCell 1997 Report)



As observed from this figure, AirCell did not selectively re-cast or remove the lowest three bins of non-zero data. If it did, all the measurements would have been removed, since they are all occurring in these lowest bins of data. AirCell, and its engineering consultant WSE, did not remove any data counts. Accordingly, AirCell should have come to the same conclusion in regards to the measurements conducted by V-COMM in the AMPS Noise Floor Study.

It should also be noted that the rural noise floor level utilized by AirCell & WSE in their recent Cross Interference tests is 13 dB stronger than the empirical data indicates in the 1997 AirCell Report.[9] AirCell and WSE do not provide an explanation regarding this discrepancy; however, they proceed to utilize these unsupported and significantly higher noise floor levels in their interference analyses, cross-interference tests and probability analyses. The results and conclusions of these analyses are invalid, since they rely upon incorrect assumptions.

Further, the noise floor measurements as provided by AirCell in its 1997 report actually validate the very low operating noise floor conditions that exist at terrestrial cell sites, as measured and reported by V-COMM. Similar levels were also observed in V-COMM tests at eighteen typical cell sites within the Philadelphia and New Jersey market areas, as submitted to the FCC in the AMPS Noise Floor Study report.

In addition, within its Engineering Report, AirCell provides an analysis calculating the cell site equipment's noise figure value in support of its position of discarding the lower bins of noise data.[10,11] However, in their analysis, AirCell incorrectly and inappropriately computes the cell site's system noise figure value as referenced to the cell site's antenna. Since all measurements in the V-COMM reports are consistently referenced to the cell site input port[12] (input port of coupler/filter assembly in AirCell figure), it is neither correct nor appropriate to compare these measurements to the calculated system noise figure value at a different reference point. Making comparisons with incorrect and inappropriate reference points is a more common error made by less experienced radio engineers. Hence, AirCell's calculated noise figure value for the AMPS cell site is inappropriately performed with an incorrect reference point for comparisons to noise measurements referenced to the cell site input.

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[9] The utilization of significantly higher and erroneous noise floor levels by AirCell has the effect of "masking" the interference of the AirCell system, and thereby invalidates the WSE cross-interference tests and renders the results irrelevant. The results of AirCell's compatibility tests should not be considered in the FCC's assessment of the compatibility of the AirCell system.

[10] With its Engineering Report, AirCell derives the cell site equipment noise figure value in its figure 2.2.c.3, and uses this value in its figure 2.2.c.1 & 2.2.c2.

[11] Within section 6.3 of the AMPS Noise Floor Study report, V-COMM provided similar analyses calculating the equipment's noise figure value in two separate methods. V-COMM provides that the cell site's system noise floor value is approximately –127 dBm, which is referenced to the cell site's input port. This is the same reference point for measurements that is used throughout the V-COMM tests and reports, as submitted to the FCC.

[12] This reference point is also the accepted practice in the cellular industry and is consistent with published standards for analog and digital cellular systems (i.e. TIA/EIA-136-280).

If AirCell had used the correct reference point for this calculation, which is the same reference point for the measurements that are provided in the V-COMM report, then it would have correctly computed this value. Using the equipment specifications provided by AirCell for the coupler/filter assembly and LNA (1.7 dB and 1.5 dB, respectively), the cell site's system noise figure is calculated to be 3.2 dB, as referenced to the cell site input port.[13] The system noise figure can vary slightly from cell site to cell site, and V-COMM believes the 3.2 dB noise figure is an acceptable value that is consistent with Lucent's specifications. Adding this system noise figure value (3.2 dB from AirCell provided specs) to –130.2 dBm (the thermal noise in an effective 24 kHz bandwidth for AMPS), equals –127 dBm as referenced to the cell site equipment input.[14] This is the same level as the lowest noise floor level referenced in the V-COMM report.[15]

Also, the noise figure calculations provided in AirCell's report incorrectly rely upon using an offset of 2.6 dB for urban and dense urban calculations, per a NTIA research paper.[16] This noise floor offset is inappropriately applied in this case. When performing subsequent noise floor measurements in various markets, the results in one market do not require the using of the previous market's results as a threshold for determining the minimum noise level measured in an another area. In this respect, AirCell's offset for the sites in the AMPS Noise Floor Study is misapplied.

Furthermore, the NTIA study provided that the referenced value was not for the cellular frequency band (it was 761 MHz), it was only exhibited within the busy (dense urban) downtown Denver, Colorado area, and some of the measurements indicated lower noise floor levels that are closer to the thermal noise level. In addition, the NTIA report concludes that the median mean power at 761 MHz is comparable to the system noise

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[13] The cell site input port is the correct reference point. (AirCell incorrectly adds the additional attenuation of the antenna system including the antenna's matching efficiency to the cell site noise figure, to reference the system noise figure to the antenna. Since all measurements are referenced at the cell site input, and not the antenna, AirCell's calculated noise figure value is an incorrect comparison of signal level reference points.)

[14] This noise floor level is lower than the Lucent warranted noise floor of –124 dBm, which can be expected. The actual performance of cell site equipment would naturally exceed the manufacturer's guaranteed minimum performance specifications. AirCell should have realized this is the case, as it configured its nearby Ellendale, DE cell site with a target DPC setting of –121 dBm referenced to cell input. With this setting and the cell site system noise floor of –127 dBm, AirCell's carrier to interference ratio is about 6 dB on average, and about 4 dB at the lower end of the power box. If the cell site's system noise floor level were higher than this level, AirCell's system would not operate properly or be able to sustain quality calls.

[15] The lowest noise measurement bin provided by V-COMM in its AMPS Noise Floor Study report represents the noise floor conditions equal to or lower than –127 dBm. (The eighteen cell sites included in the AMPS Noise Floor Study did not utilize tower-mounted LNA equipment, which would have further reduced the noise floor of the cell sites by about 2 dB.)

[16] AirCell references the NTIA research study as performed in 1999. The NTIA research report is dated December 2001.

of their measurement equipment,[17] and also indicates that noise floor levels decreased with increasing frequency. Also, the report concludes that external, man-made noise is less than what has been predicted by previous modeling techniques which indicates that the noise environment is actually lower than anticipated. This further supports the low noise floor measurements as performed by V-COMM. Therefore, there is no reason to conclude that the man-made noise floor for urban environments in the PA/NJ area in the cellular 850 MHz band should be elevated by 2.6 dB. For these reasons AirCell has misinterpreted the results of the NTIA noise study.

AirCell Assertion

2. The AMPS noise floor measurements require re-casting to represent the higher interference levels, and the noise levels during quieter times of the day should not be considered. Carrier's operating signal level needs to be 17 dB above the highest peak noise floor level from the noise floor levels re-cast by AirCell. 100% of all calls must maintain this margin 100% of the time.

As stated earlier, Lucent Technologies (the cell site equipment manufacturer) does not recommend removing the lowest three bins of non-zero measurement data. All measurements collected during the measurement period are valid. The data represent the fluctuation in the noise floor across the hours of the day, and within each hour, from the highest to the lowest noise floor values. To consider only the highest, peak noise floor value that occurs for extremely brief moments in time (i.e. for only seconds within a 24-hr period) is not meaningful or significant. For example, a peak noise floor level reading occurring for 30 seconds in a 24-hour period only represented the noise floor of the wireless network 0.03% of the time. And, 99.97% of the time, the actual noise floor levels are much lower than this peak. AirCell's reliance on the peak, highest noise floor value for its analyses is flawed, as it only represents a statistically insignificant period of time when compared to the actual operating noise floor for the majority of the day. For these reasons, the median noise floor value should be utilized for analyzing interference from secondary services in cellular spectrum.

Furthermore, wireless carriers expend significant engineering efforts optimizing their networks and the peak periods of the day are the most difficult periods. A carrier's radio engineers typically utilize channel assignment algorithms, underlay/overlay algorithms, and other technologies to optimize the performance of their networks, however these algorithms provide less improvements in the busiest minutes of the day (i.e. when all channels are utilized at all the surrounding cell sites at the same time). This is how practical wireless systems operate, providing quality service for the majority of the day. It is not practical to build a wireless network that provides 17 dB carrier to interference (C/I) margin 100% of the time to 100% of the coverage areas. Wireless systems are designed to provide service to specific coverage areas, and with specific fade margin

[17] The NTIA report clearly states that the values reported include the system noise of the receiving system and that the externally generated noise could not be determined "with any reasonable accuracy".

criteria. Fade margins are not designed to be met 100% of the time. Typical design criteria is 90% for coverage availability, which translates to a particular fade margin in dB. At the edges of the cell coverage areas, this translates to less than the required C/I margin for up to 25% of the time. All radio systems are designed with these practical tolerances. However, AirCell seems to overlook these tolerances in its assessment that the operating signal level of all terrestrial cell sites must be 17 dB above the peak, highest noise floor level, all the time. This is a highly impractical assessment. It is impossible for a carrier to maintain the 17 dB margin of signal to interference level 100% of the time for 100% of the calls on 100% of its cell sites. This would require building cell sites on every corner of every street, and on every floor of every building, to provide service to every single call on its network at the 17 dB C/I margin 100% of the time.

Wireless carriers typically design their systems to meet the optimum conditions that can be met within practical design constraints. In setting the cell site's operating signal level points, they generally follow vendor guidelines and perform further fine-tuning to meet specific market applications. Typically, carriers utilize the 90% highest noise floor value or similar noise levels for setting their operating signal level points to meet their network design criteria. (The 100% highest value is not utilized, as it is not practical.) The mobile phones can only power up to their maximum power levels, and a carrier would never achieve meeting the design criteria of 100% of the calls, 100% of the time, even if all calls were at maximum power all the time. Having all mobile phones increasing in transmit power levels can also be self-defeating, as the system's interference noise floor would increase with it, which reduces the C/I margin. So, the carrier's operating signal level points are not set to 17 dB above the 100% highest noise floor level for these reasons. In practical systems, the 90% noise floor level is used as a general guideline in conjunction with the operating signal level distributions to achieve the C/I performance margin criteria for a minimum of approximately 90% of the time.

In a further analysis within the AirCell Engineering Report, AirCell suggests that the operating signal levels must be shifted by 22 dB above the currently measured signal levels for the terrestrial cell site. This analysis is completely absurd. Even in the extreme case of an AMPS phone at its lowest power level (DPC 7) directly below a cell site tower, the maximum it can power up is 20 dB (DPC 2). Therefore, it is impossible for an AMPS mobile phone to even power up by 22 dB! At the edge of the cell site or within buildings the AMPS phones are typically at their maximum power, and therefore cannot power up by even 1 dB, let alone the suggested 22 dB. AirCell needs to understand that the operating signal levels that are received at the cell site below the –90 dBm levels are already at maximum phone transmit power, since it would be below the normal settings for cell site's dynamic power control (DPC) settings. As a result, these AMPS phone calls are at maximum power (600 mW) and cannot power up by 22 dB. A 22 dB increase in power level for these phone calls would cause it to transmit at a power level of 95 Watts ERP. Obviously, this is an absurd analysis, which is void of any significance. Again, AirCell's shifting-up of signal level measurements is akin to its re-casting of noise floor measurements, both of which are invalid. AirCell is simply attempting to pick and choose which signal and noise measurements that it deems appropriate, and then manipulate the data in efforts to back-up their claims of non-interference to the terrestrial cellular networks.

The FCC should also consider that carriers have optimized their networks, and for most of the day the noise floor is much quieter than the peak, busiest time of the day. Terrestrial cellular service is the primary service in the band, and is entitled to fully utilize the spectrum in the quieter times of the day. Terrestrial cellular customers include working people, parents, teens, callers in distress and emergencies, government workers, public safety personnel, people responding to national security incidents, local police, fire & ambulance workers, and many others that rely on terrestrial cellular service. 35% to 50% of all 911 calls are made from wireless phones. A greater percentage of the population is converting landline service to wireless service than ever before, which also increases in-building usage. Wireless service is currently used by approximately 50% of the U.S. population. There are significant public benefits in preserving the existing wireless services, and the FCC must protect these services from harmful interference. In addition, the same protection should be provided for the advanced wireless services being offered by carriers, including high-speed Internet access and other advanced voice and data services.

AirCell Assertion

3. Noise floor data re-cast by AirCell, and signal level data shifted-up by AirCell, shows supportive material regarding the FCC's –100 dBm minimum call level, as used by the FCC in its Order on Remand.

As V-COMM has described above, the noise floor data re-cast by AirCell and signal level data shifted-up by AirCell are invalid manipulations of valid measured data. AirCell is simply attempting to "pick and choose" the signal and noise values it desires to have a better showing of compatibly with the terrestrial network. When considering the actual measurements of the cell site operating noise floor levels, the data does not support the –100 dBm minimum AMPS call level.

The minimum AMPS call level is much less than –100 dBm, and can be as low as –110 dBm while maintaining the 17 dB C/I margin at AMPS cell sites having an operating noise floor level close to their system noise floor, which is approximately –127 dBm. This noise floor level was observed in many cell sites for the majority of the time, in the AMPS Noise Floor Study. For more information on the operating noise floor levels at typical AMPS cell sites refer to the Test Results, Conclusions and Analysis sections of V-COMM's AMPS Noise Floor Study. For more reference material regarding the minimum AMPS call signal level refer to V-COMM's "Engineering Analysis of the FCC Order on Remand".

AirCell Assertion

4. The Lucent Power Level Measurement (PLM) function skews the measurement data with significantly more samples collected during the nighttime period.

This assertion is significantly overstating the actual impact to the PLM measurements. Lucent's PLM noise floor measurements perform measurements at regular intervals during the measurement period, and records the operating noise level on the specified channel. The noise floor measurements are performed throughout the 24-hour period for the AMPS Noise Floor Study. Throughout this period the variation in samples recorded during the busier times of the day (as compared to non-busy periods) is not statistically significant, and thus does not impact the overall results.[18]

To demonstrate that there is no impact, we recently collected additional PLM data in four 6-hour periods for one of the urban cell sites that was included in the AMPS Noise Floor Study. The noise measurements were collected in four separate and sequential 6-hour periods,[19] with noise measurement data counts that collectively added up to the 24-hour period. The number of measurement counts (or noise floor samples) recorded within each period varied by only a small percentage. Also, the noise floor values for the busier periods of the day are similar to non-busy periods, which further reduces any impact. For these reasons, the impact is hardly discernable, and does not significantly impact the results. If these noise floor samples (counts) were adjusted to equally weighted counts for each of the four measurement periods,[20] the results are similar to the standard processing (with no weighting) of the measurements for the 24-hour period, as provided in the two figures below.[21]

[18] The eighteen cell sites utilized in the AMPS Noise Floor Study were operating at traffic levels below levels that would produce significant channel blocking. Therefore, the sampling on idle channels in the busier periods of the day are not very different than sampling during the non-busy periods.

[19] The four measurement periods were 12 AM to 6 AM, 6 AM to 12 PM, 12 PM to 6 PM, and 6 PM to 12 AM.

[20] For the results with equal weighting, the data counts were adjusted to represent the same number of measurement samples (counts) in each of the four periods.

[21] As depicted in the figures, the probability values for noise measurement histograms for the standard data counts and the equal weighted data counts, are 83.61% vs. 83.63% for the lowest bin, 15.74% vs. 15.70% for the 2nd bin, and 0.25% vs. 0.26% for the 3rd bin, respectively. Also, the median (50%) operating noise floor value for this urban site has the same results in both cases.

Figure 3-B Noise Floor Measurements using Standard Data Counts

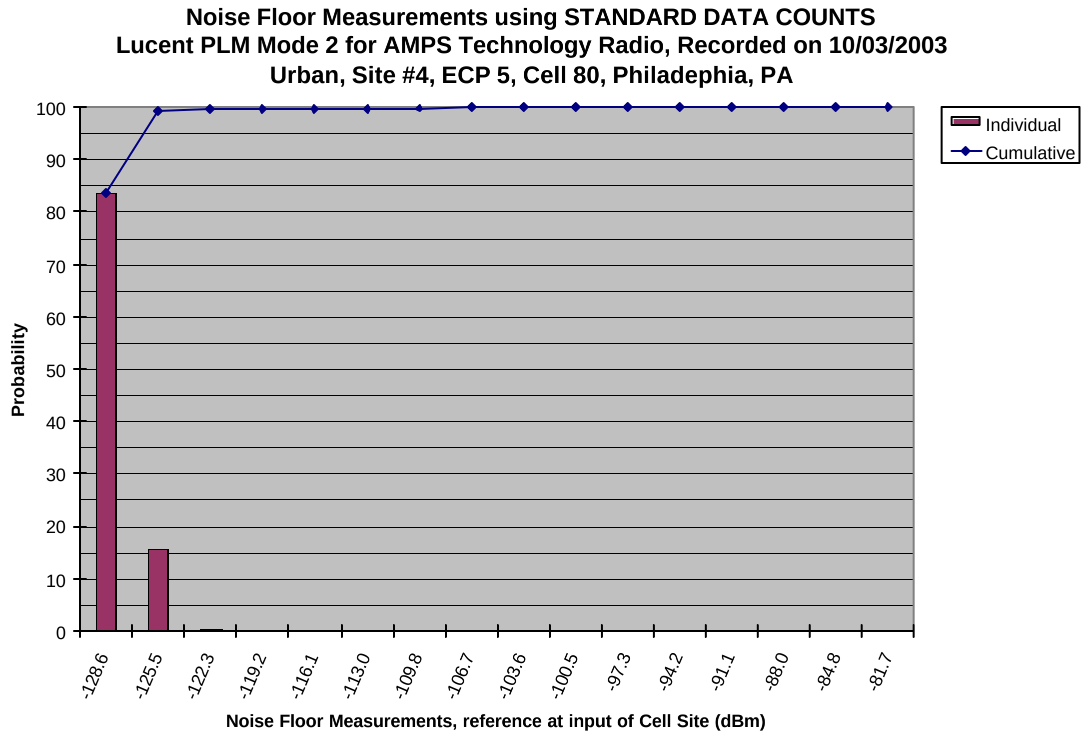
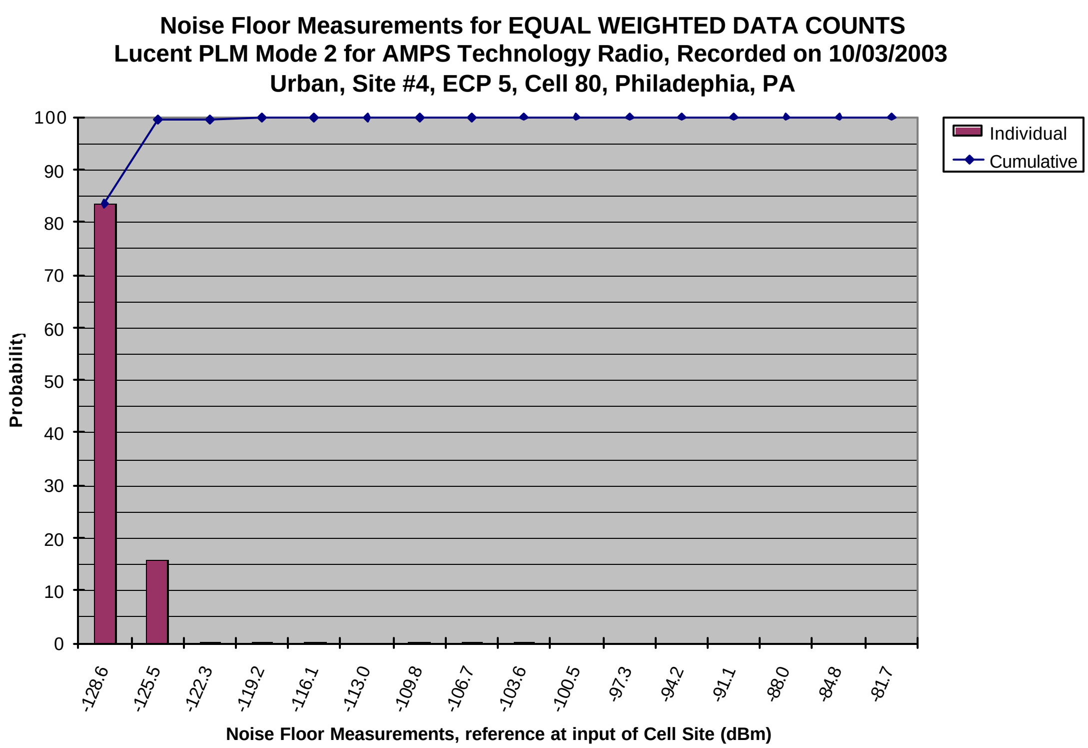


Figure 3-C Noise Floor Measurements for Equal Weighted Data Counts



AirCell also states that the channel should have been "cleared" (removed) from service to allow perfectly consistent PLM Mode 2 sampling throughout the day. However, it should be noted that the Lucent base station equipment is not capable of performing PLM mode 2 noise measurements on a channel that is not in-service. So, the channel must remain in-service during the measurement period.

It is also worth noting that AirCell's noise floor measurements, as submitted to the FCC in its 2003 reports and its 1997 report, were performed on channels that were not removed (taken out of service) during their measurements. This is another case of AirCell being disingenuous with its criticisms of V-COMM's tests, and also contradicts the tests it has conducted and submitted to the FCC. AirCell does not acknowledge this apparent inconsistency with its reasoning … if the AirCell test data is valid, why isn't V-COMM's test data valid, for the same reasons? Lastly, V-COMM is confident with the methods utilized in the AMPS noise floor measurements, and they are consistent with acceptable engineering practices. It is also consistent with AirCell's recorded noise measurements, as submitted to the FCC.

AirCell Assertion

5. Cell site receiver calibration tests should have been performed with receive antennas disconnected.

V-COMM utilized test procedures that allowed the calibration tests to be completed with antennas connected without impacting the tests, as explained below. During these calibration tests, the test engineer used the signal generator with a tone modulation of 1 kHz. The calibration tests included establishing a telephone call to a landline phone, where the test engineer was able to listen to the quality of the audio tone generated and any distortion caused by the background interference and noise levels on the same channel. When the audio quality of the tone was clear, the test engineer performed the calibration measurements on the radio channel, which assures that the interference on the channel does not have a significant impact to the injected signal level. When the tone was distorted by the interference, which is when a nearby co-channel mobile is using the same channel, the test engineer temporarily suspended the calibration measurements until the call and interference went away, and the audio quality of the tone had resumed. Using this method of procedure with a qualified and experienced test engineer, V-COMM was able to perform calibration measurements with the antennas connected, which prevented co-channel noise from impacting the measurements.

In addition, there were secondary reasons for performing the calibration tests with the cell site antennas connected as normal. The second part of the calibration tests included a procedure to establish the minimum signal call level with no SAT muting. These results are provided in Table 5.1 of the AMPS Noise Floor Study report. This provides useful insight to the operating interference noise floor level during the day when calibration tests occurred during normal operation of the terrestrial cell site.

These secondary measurements cannot take place with the cell site antennas disconnected.

In summary, V-COMM performed calibration tests with the antenna connected during normal business days for the reasons stated above, since it was using a test method that prevented the measurements from being corrupted. In addition, to further confirm the previous calibration measurements, V-COMM recently performed calibration tests at a sample of the cell sites, as described below (see AirCell Assertion # 7). These new calibration tests yielded similar results,[22] and thereby confirms the previous test results.

AirCell Assertion

6. Cell site receiver calibration tests should have been performed with signal generator connected to the cell site's coupler input port.

V-COMM utilized the cell site's coupler –50 dB port to perform the calibration measurements. This port has been measured to 50 dB below the input signal level at the coupler's input port (Lucent refers to this as the J1 port). This tolerance typically varies by less than 0.5 dB, and is typically measured to within a few tenths of the expected value of –50 dB, which matches the coupler port's specification.[23]

AirCell Assertion

7. Cell site receiver calibration tests should have been performed on both of the cell site receive diversity paths.

The calibration measurements were only performed on one of the cell site diversity paths for the reason that the two diversity paths are normally equivalent. V-COMM has conducted such receive path gain measurements at Lucent series 2 cell sites in previous tests, and concluded that both diversity paths exhibit similar results. On average, the two diversity paths are within 1 dB of each other. Also, since the study included measurements at a comprehensive amount of cell sites (eighteen sites were included in the AMPS Noise Floor Study), any abnormal conditions would have been observed in the results. Lucent's subject matter experts also agree that the two paths should be very close in level, as the cell sites are designed and built to be the same. Handoff and power control algorithms would not work well if these paths were very different. The Lucent equipment normally alarms the operator under conditions when

[22] The test results exhibited within 1 dB of referenced values, on average, which is within normal tolerances as exhibited in previous tests.

[23] V-COMM has performed such measurements at many cell sites in the past to confirm this finding, and also recently performed these measurements for a sample (seven) of the eighteen cell sites that were included in the AMPS Noise Floor Study. For both receive paths of the cell sites, the attenuation provided by the –50 dB coupler port as compared to the cell site's J1 port, was –49.9 dBm on average, and within the range of –49.5 dB to –50.5 dBm.

one receive diversity path is selected over the other for more than 60% of the time.[24] If this occurs, a hardware failure alarm is indicated on the read-only printer (ROP) at the switch. And, in cases when this alarm does occur, it is usually due to a connector in the site's transmission line or antenna, which is outside of the cell site building, and not due to cell site receive diversity paths from the cell input to the radio.

It should also be noted that AirCell is once again being disingenuous with its claims. AirCell logically believes that both receive diversities are approximately the same levels, as it performed their TDMA & CDMA Cross-Interference tests on only 1 diversity path and not both. If AirCell believes so strongly that the cell's receive path diversities can vary that much, it must also believe its own cross-interference test results are invalid for the same reason.

In addition, to further confirm the previous calibration measurements, V-COMM recently performed calibration tests at a sample (three) of the cell sites that were included in the AMPS Noise Floor Study. The recent calibration tests include both diversity receive paths, testing in off-hours with the cell site antennas disconnected, and with the signal generator connected to the cell site input (Lucent references as J1 port). These new calibration tests yielded similar results,[25] and thereby confirms the previous test results.

For example, as provided in Table 3-A below, the results of the calibration tests confirm that the cell site's two diversity receive paths are within similar accuracy tolerances and reported similar signal strength values. These calibration test are performed in off-hours with the cell site's antennas disconnected (cell site is taken out of service), and the signal generator connected to the cell site input port (J1 port).[26] The average level recorded by the RF Call Trace was within 1 dB of the signal generator referenced value.[27] The average delta for the first diversity receive path (Rx0) was -0.5 dB from the referenced levels, and for the second diversity receive path (Rx1) was 0 dB.

[24] The Lucent equipment monitors the cell site diversity receive paths on an ongoing basis. The equipment monitors both diversity paths for signal level consistency and reports hardware failure alarms when these paths are not receiving similar signal levels. The cell site's receive diversity paths are designed to be equivalent.

[25] The test results exhibited within 1 dB of referenced values, on average, which is within normal tolerances as exhibited in previous tests.

[26] A calibrated signal generator was connected to the J1 port for these tests, with a test cable having an attenuation of 1 dB and a pad attenuator of 20 dB. The measured loss for the pad and test cable was 21 dB. The receive path gain from the J1 port to the cell site radio is 15 dB per Lucent specifications.

[27] The signal generator output signal levels were maintained at the referenced levels for approximately 1 minute, and the average value for these periods were recorded from the RF Call Trace data. The Lucent RF Call Trace records signal strengths as referenced to the cell site radio. The signal generator modulated two tones for these tests; one tone was for the AMPS Supervisory Audio Tone (SAT), and the other tone to represent voice (using a 1 kHz frequency and deviation of 2.9 kHz).

Table 3-A Calibration Test Results For Both Receive paths (Rx0 and Rx1), Input at J1 Port, and Testing with Antennas Disconnected

Site #	4	Switch #	5	Cell #	80			
Level at Signal Generator (dBm)	20 dB Pad + 1 dB Cable Loss	Sig Gen @ J1 port (dBm)	Cell Rx Path Gain to Radio (dBm)	Sig Gen @ Radio (dBm)	Rx0 AVG Level From Call Trace	Rx1 AVG Level From Call Trace	Rx0 Delta (Error)	Rx1 Delta (Error)
-60	-21	-81	15	-66	-66.0	-66.0	0.0	0.0
-65	-21	-86	15	-71	-72.0	-71.0	-1.0	0.0
-70	-21	-91	15	-76	-77.0	-77.0	-1.0	-1.0
-75	-21	-96	15	-81	-82.0	-82.0	-1.0	-1.0
-80	-21	-101	15	-86	-87.0	-86.4	-1.0	-0.4
-85	-21	-106	15	-91	-91.0	-91.0	0.0	0.0
-90	-21	-111	15	-96	-96.9	-95.5	-0.9	0.5
-95	-21	-116	15	-101	-101.8	-101.9	-0.8	-0.9
-100	-21	-121	15	-106	-106.5	-105.0	-0.5	1.0
-103	-21	-124	15	-109	-109.5	-109.2	-0.5	-0.2
-105	-21	-126	15	-111	-111.0	-110.0	0.0	1.0
-106	-21	-127	15	-112	-111.6	-111.0	0.4	1.0
						AVG =	**-0.5**	**0.0**

AirCell Assertion

8. More accurate test equipment should be utilized to perform the operating noise floor measurements instead of using the cell site receiver (PLM measurements) for these measurements.

V-COMM utilized the cell site receiver for these measurements with the Lucent PLM measurement tool. These tools are utilized by the vendor and carrier's engineers to perform signal and interference measurements on channels, as observed and measured by the cell site radios. Lucent states that these tools are accurate and are designed for such measurements. Further, the reason V-COMM performed calibration measurements on these receivers was to ensure the receivers were not performing abnormally and were reporting readings accurately and consistently. This allowed the cell site receivers to be utilized for such measurements. Also, the benefit of using the cell site receiver for these measurements is that it has the perfectly matched receiver specifications (resolution bandwidth, system noise figure, etc.) to the cell site receiver that is under test.

The wireless carrier's radio engineers typically utilize these PLM mode 2 measurements to measure the system's operating noise floor levels, and they are consistent with acceptable engineering practices. These levels are the operating noise levels experienced by the cell site receiver occurring throughout normal operation.

AirCell Assertion

9. The eighteen cell sites and channels selected may be atypically lower than the normal cell sites in the surrounding market areas.

This is simply not true. These cell sites were selected as typical cell sites with representative signal and noise floor levels for sites in the market environments described as dense urban, urban, suburban, and rural areas within the NJ & Philadelphia, PA markets. The first voice channel seized during calibration testing on the sector determined the channel that was selected for testing.[28] This was the AMPS voice channel that was utilized for the AMPS Noise Floor Study. There was no effort to select the cleanest cell sites, sectors or channels. These were all selected to be representative of typical cell sites having normal operating noise floor levels within the market.

The results of these noise measurements were similar to other noise measurements performed by AirCell. The eighteen surveyed sites in the AMPS Noise Floor Study exhibited low operating conditions that were similar to the levels observed in AirCell's noise measurements for the Waurika site in 1997, and Madill site in 1998.[29]

[28] Other channels and sectors of the eighteen cell sites should exhibit similar operating noise floor levels. For these reasons, the first channel seized during the calibration tests was the only channel utilized in the noise measurement study.

[29] AirCell has submitted to the Commission noise measurements from the Waurika terrestrial site in 1997 (Figure 7.9 of the AirCell 1997 Report), and from the Madill TDMA site in 1998 (Figure 2.6.b.3 of AirCell's Engineering Report). As observed in these figures, Madill's mean noise level was –126.9 dBm, and Waurika's about –130 dBm. The noise measurements from the AMPS Noise Floor Study showed similarly low operating noise conditions for the terrestrial cellular network.

4 V-COMM's AirCell Compatibility Flight Tests

Within its Reply document and Engineering Report, AirCell provided several criticisms in relation to the test procedures and results of the V-COMM's AirCell compatibility flight tests. These flight tests were utilized to characterize AirCell system compatibility to the terrestrial networks. AirCell's criticisms are addressed below and are inaccurate statements relating to V-COMM's flight tests conducted in cooperation with participating carriers and with the supervision of Lucent Technologies, the manufacturer of base station equipment utilized in this market and testing.

AirCell's assertions regarding V-COMM's flight tests are summarized below:

1. V-COMM's straight-line flight paths are not representative of typical flight patterns. They may have been flown in short segments. Flight path turns at end of bow-tie pattern resulted in high interference to ground cellular system. Accomplishing actual flight pattern provided and coordination with FAA air traffic controllers is nearly impossible.
2. AirCell's Marlboro site receive antenna is obstructed by nearby trees, which results in a loss of one of its receive diversity paths causing an increase in the power level transmitted by the AirCell mobile for the V-COMM flight tests with DPC enabled.
3. AirCell's network of base stations was not fully built out in the Marlboro area, and AirCell told this to V-COMM. Also, AirCell intended on installing a Smart Antenna at the Marlboro site.
4. AirCell indicated that a cell site translation parameter (DPC Boost) was incorrectly set for the V-COMM flight tests with DPC enabled.
5. AirCell indicated that handoffs were not configured for the Marlboro AirCell site for the V-COMM flight tests with DPC enabled, and this causes the flight test results to be unrepresentative of the AirCell network.
6. AirCell indicated that two of the three AirCell mobile phones were not formally inspected and checked by AirCell.
7. AirCell indicated that some measurements at the Oak Hill site defy free space propagation characteristics for reasons that the measurement equipment was either not accurate or had a higher noise floor than other test receivers used at the two other terrestrial cell sites utilized in Phase 1 flight tests.
8. AirCell indicated that terrestrial cell sites selected for Phase 1 Flight Tests were not representative of typical sites with sector antennas down-tilted.

These assertions are provided within section 2.3 of AirCell's "Engineering Review of V-COMM Reports" document, which contains 34 pages of analyses and statements within its engineering review report.

These issues are addressed below and should be dismissed as inaccurate statements relating to V-COMM's AirCell compatibility flight tests.

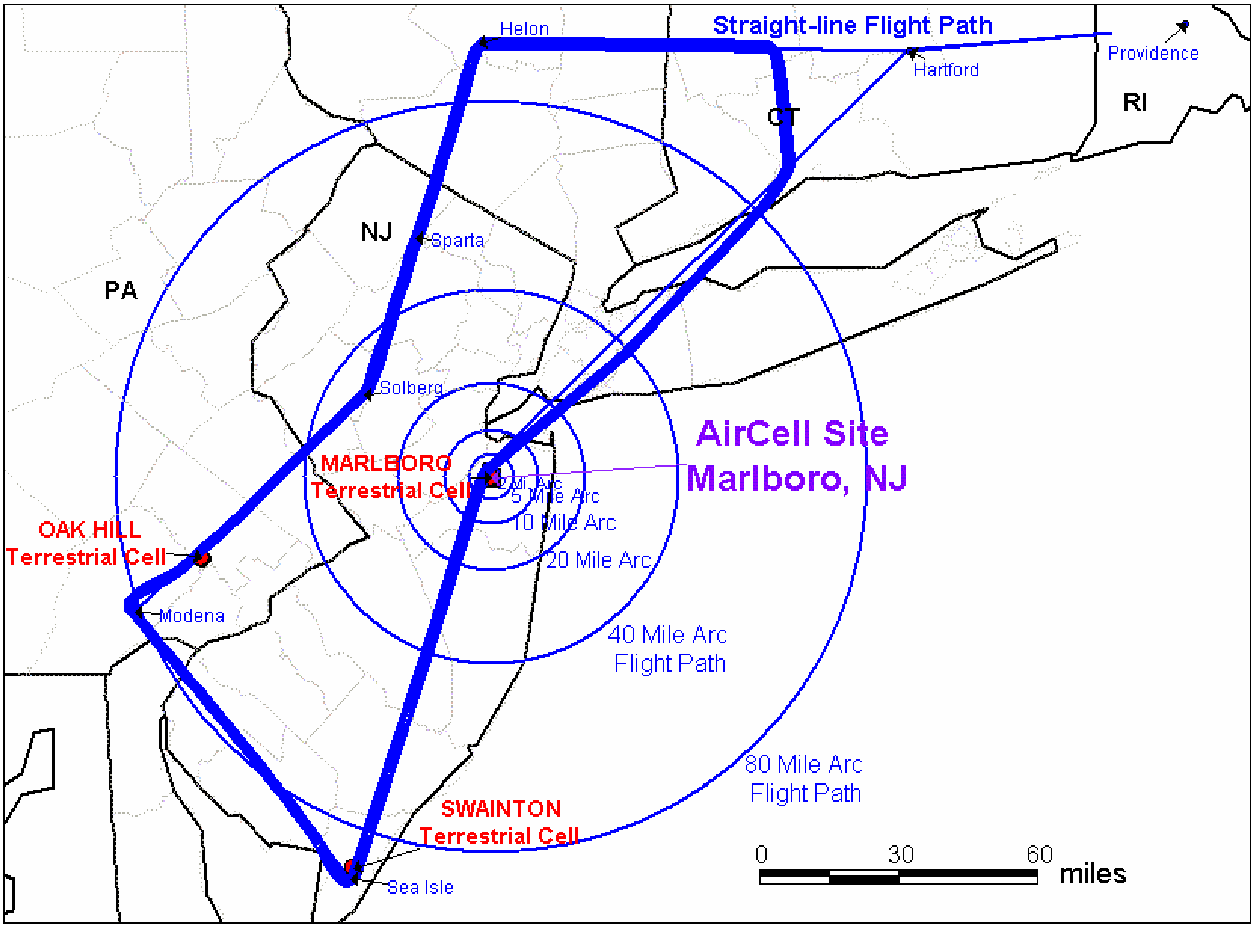
AirCell Assertion

1. V-COMM's straight-line flight paths are not representative of typical flight patterns. They may have been flown in short segments. Flight path turns at end of bow-tie pattern resulted in high interference to ground cellular system. Accomplishing actual flight pattern provided and coordination with FAA air traffic controllers is nearly impossible.

As shown in the diagram below, the flight patterns flown in the V-COMM straight-line flight tests appear to resemble a bow-tie pattern. There are two primary reasons for this. First, the "ends of the bow-tie" were needed for logistical reasons, i.e. the aircraft needed to be turned around upon reaching the end of the AirCell site service area. Second, the flight segments with northern and southern headings were utilized to measure the AirCell signal strengths at different orientations to the terrestrial cell sites, i.e. aircraft heading toward, away from, and adjacent to the victim terrestrial cell sites where measurements were performed. The flight pattern consisted of a series of VOR stations to enable the flight segments to be representative of the typical "roadways in the sky" that general and commercial aviation aircraft typically utilize. These VOR stations were also used as navigation points to maintain course. VORs are commonly used as waypoints in both VFR and IFR flights. Therefore, the straight-line flight pattern used in the V-COMM flight tests is representative of typical aircraft flight patterns within the tested area. In most cases, at the "ends of the bow-tie" pattern, AirCell service from the Marlboro site was not provided to the AirCell mobile. For example, within the flight segment from Sea Isle VOR to Modena VOR, the AirCell mobile was served by the AirCell Ellendale, DE site, and such measurements are not included in the V-COMM test results since we only performed measurements on the channel utilized by the Marlboro AirCell site. Therefore, these flight segments at the "ends of the bow-tie", furthest from the AirCell Marlboro site, do not contribute to any higher signals encountered as asserted by AirCell.

Finally, all the flight patterns utilized in the V-COMM flight tests were coordinated and approved by the FAA's air traffic controllers for the area. The flight patterns followed the flight diagram provided by V-COMM in its report that was submitted to the FCC. In the figure below, the GPS coordinates from a GPS receiver on-board the aircraft was utilized in the V-COMM flight tests to provide the aircraft location information. This coordinate data is plotted on the flight map exhibit below for the flight at 10,000 feet elevation. It can be observed from this figure, that the aircraft did not reach the Hartford VOR for reasons that there was no AirCell service provided from the Marlboro AirCell site at this flight altitude. Consequently, the pilot did not need to continue all the way to the Hartford VOR for this flight altitude, and the aircraft continued back along the flight pattern in the southern direction. Again, for most altitudes, these outer most edges of the flight pattern did not receive service from the Marlboro site, and therefore do not contribute to any higher signals encountered in the V-COMM flight test results.

Figure 4-A V-COMM Straight-line Flight Test



Furthermore, AirCell is operating under secondary service provisions within cellular spectrum, and must not cause harmful interference to terrestrial networks under any circumstance. In summary, the straight-line flight patterns utilized in the V-COMM flight tests were representative of typical aircraft routes for the area.

AirCell Assertion

2. AirCell's Marlboro site receive antenna is obstructed by nearby trees, which results in a loss of one of its receive diversity paths causing an increase in the power level transmitted by the AirCell mobile for the V-COMM flight tests with DPC enabled.

V-COMM's Response: AirCell coordinated with Cingular's local operations staff to configure the AirCell base antennas for the Marlboro site. AirCell specified and agreed to the antenna mounting heights for these antennas. Further, AirCell's director of its engineering personnel came to the Marlboro site to configure the Marlboro site translation parameters settings, and fully optimize its Marlboro base site. For this optimization, AirCell performed visual inspections of the antenna system, installed its

CTSU equipment, and performed numerous off-air tests and on-air flight tests on the Marlboro site, after it configured and optimized it. At the conclusion of its inspection and optimization of the Marlboro site, AirCell informed V-COMM that the Marlboro site was optimized in accordance to AirCell standards. From that time until the time AirCell submitted its Reply Comments to the FCC, AirCell neither stated that any of its base antennas were too low, nor indicated that any other condition existed that was not representative of other AirCell sites in its network.

Further, in response to AirCell's comments, Cingular hired an independent contractor to locate and measure mounting heights of the AirCell antennas at Marlboro. This can be seen in the diagram below (Figure 4-C). The AirCell receive antennas are mounted upright, as electrically up-tilted antennas purchased from Scala that are specifically tuned to the cell site receive band. The receive antennas are not mounted inverted as AirCell showed in their figure 2.3.b.13 (reproduced in Figure 4-B below). Therefore, the tree line does not have any impact on the V-COMM test results. If the antennas were mounted as labeled by AirCell in its Reply Comments, the Marlboro site would not have been operating properly. AirCell's engineering personnel should know which antennas are mounted upright vs. inverted; however they incorrectly pointed to the wrong antennas to manufacture an issue out of nothing. It can be seen that the tree line only obstructs AirCell's transmit antenna that is mounted on the lower boom, in the inverted position, which is connected to the cell site's linear amplifier #4 (LAC4). It should be noted that the channel utilized in the V-COMM phase 1 flight tests was from LAC3, which is connected to the transmit antenna on the upper boom that is inverted and not obstructed by the tree line. Hence, the V-COMM flight tests were not affected by the lowest inverted transmit antenna (that is the only antenna obstructed by the tree line), since that antenna was not utilized in its flight tests.

Figure 4-B AirCell Incorrectly Labeled its Receive Antennas in its Marlboro Site Photo (Reproduced from AirCell's Figure 2.3.b.13. Correct label for receive antennas in red)

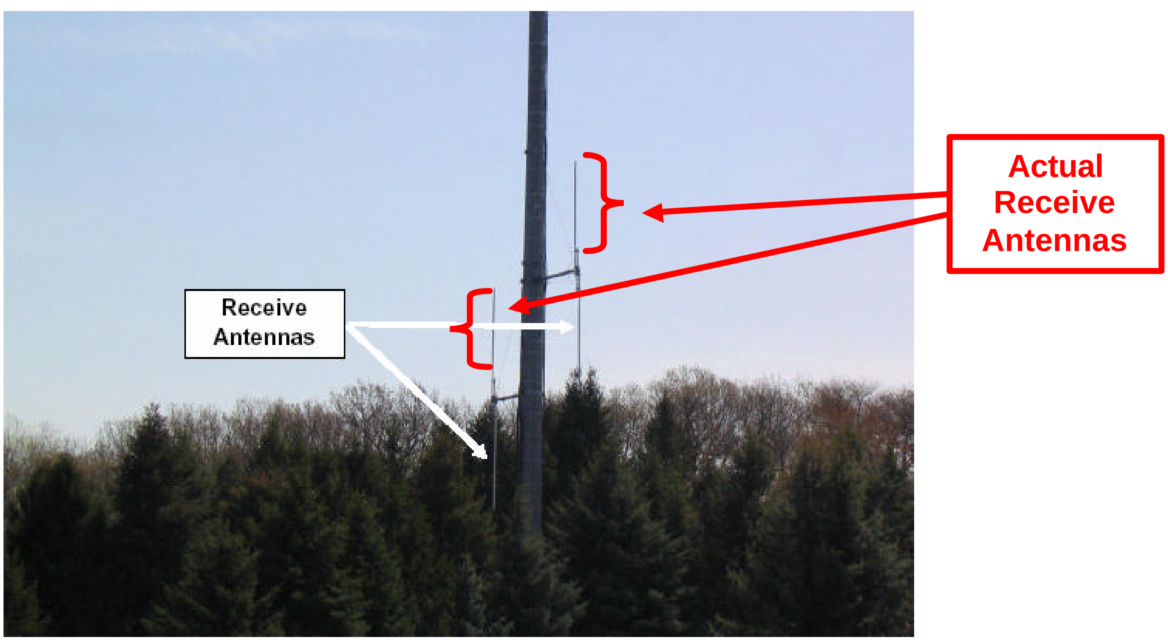
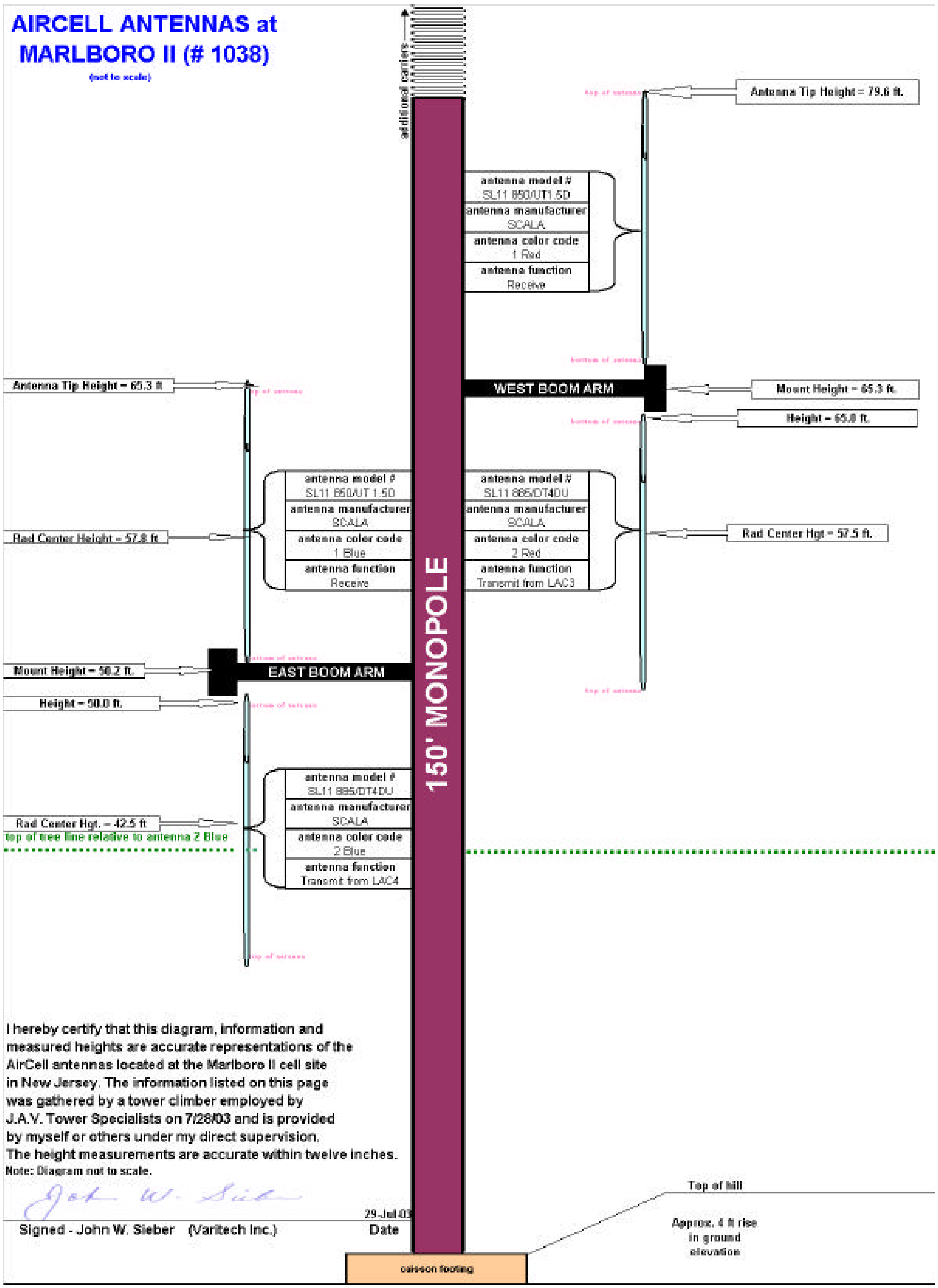


Figure 4-C AirCell Antennas at Marlboro Site (From Cingular's Response, Section 10.2)



AirCell Assertion

3. AirCell's network of base stations was not fully built out in the Marlboro area, and AirCell told this to V-COMM. Also, AirCell intended on installing a Smart Antenna at the Marlboro site.

V-COMM Response: AirCell has never mentioned that the Marlboro area was not fully built out. This is a new issue AirCell is attempting to introduce at the 11th hour in a proceeding that is studying its typical AirCell base station. The typical distance between other AirCell base sites around the U.S. is about 160 to 200 miles. AirCell has stated in the record that its base station's service radius is typically between 80 to 90 miles. However, after V-COMM conducted its flight tests utilizing the AirCell Marlboro site, AirCell decided to secure an additional cell site between the AirCell Marlboro, NJ site and AirCell Owego, NY site. This new AirCell site is located within cellular RSA PA#5, which is about half way between Marlboro & Owego.

The distance between the AirCell's Marlboro, NJ site and their Owego, NY site is about 160 miles, which yields a typical AirCell serving area of about 80 miles for each site. However, with the addition of this new site AirCell has cut the service radius to about 40 miles, which is significantly less (about half the standard radius) than other AirCell sites in the U.S. This action was taken by AirCell after testing was completed for the Marlboro site, and should be viewed as a last resort attempt to discredit the V-COMM flight tests.

Even if the new AirCell site within the RSA PA5 market was in operation it would have only had minimal effects on the flight data collected by V-COMM in its flight tests, since most of the time the Marlboro site would serve the flight path rather than the new site. Only the flight segment from the Sparta VOR to Helon VOR might have been served by the new AirCell site, which represents about 40 miles of the 530 miles of the straight-line flight test, or about 7.5% of the total flight path. AirCell also stated that there were other new sites in the area as well, however these other sites were too far away from the V-COMM's straight-line flight pattern to have a significant impact.

In addition, AirCell sites do not normally handoff since its sites are in markets that are too far apart and require additional long-distance leased lines that are not economical for its service. This is the same case for handoffs from AirCell's Marlboro site to its PA5 site. Since AirCell has not configured handoffs for this site, the call would remain on the Marlboro site for the entire flight path in any case. In addition, even in cases where handoffs are configured, the handoff hysteresis function would delay the handoff from occurring until the signal received at the new site was several dB higher (typically 5 to 6 dB higher) than the serving site. Under line of sight (LOS) propagation, this translates to many miles in distance. So, in the case of a configured handoff between the Marlboro & PA5 sites (which is not setup today), the Marlboro site would have most likely served and carried the airborne call for the duration of the V-COMM straight-line flight tests. Lastly, the V-COMM straight-line flight tests are representative of typical flight patterns within the service areas of typical AirCell base stations across the U.S. that have service radii of 80 to 90 miles.

Regarding the Smart Antenna, AirCell's original agreement with the previous carrier that owned the Marlboro cell site (Comcast) only referenced the standard antenna configuration for this site. Only after AirCell heard that flight tests were to be conducted on the Marlboro site, did AirCell indicate it desired to install a smart antenna at this location to improve its compatibility with the terrestrial network. For this installation, AirCell needed to coordinate with Cingular (the new Licensee) to update its original agreement to include the operation of smart antennas on the tower. However, AirCell did not secure this agreement for this work to be implemented. Further, a tower study was needed to ensure the additional loading of the smart antennas did not exceed the tower manufacturer's design specifications for the structure. Hence, the AirCell Marlboro site is still in operation today, just as it was when AirCell configured and optimized it with its standard antenna configuration almost 4 years ago. The significant issue is that the AirCell Marlboro site, as tested by V-COMM in its Phase 1 flight tests, represents a normal and standard AirCell base site configuration that is similar and representative of the majority of the AirCell sites in the U.S.[30] It should be noted that V-COMM made repeated requests of AirCell to allow flight tests at another AirCell site having a smart antenna system. AirCell indicated it had smart antennas installed at 3 other AirCell sites in the U.S., but it would not cooperate to allow V-COMM to test at these sites. In any case, the smart antenna configuration needs to be considered by the FCC as a special case, as it's not standard base equipment for AirCell (3 deployments for 135 sites is very uncommon), and it is not listed as a technical requirement for operation pursuant to the AirCell waiver.

AirCell Assertion

4. AirCell indicated that a cell site translation parameter (DPC Boost) was incorrectly set for the V-COMM flight tests with DPC enabled.

V-COMM Response: Cingular's performance staff inadvertently set the "DPC Boost" parameter for one day of flight tests. This was discovered, and that flight data was removed from the V-COMM flight test results. AirCell had full knowledge of this, and can verify such data was not submitted to the FCC, since the DPC parameter never reached DPC level 2 during any of the DPC enabled tests (which would be a clear indication of the "DPC Boost" parameter being active).[31]

[30] The AirCell Marlboro site is representative of a standard operating and configured AirCell base site; however, it should be recognized that AirCell set the maximum DPC setting for this site to a DPC level of 3, which is approximately 30 mW. Consequently, the Commission should recognize that the interference would be higher if the AirCell system utilized a DPC setting that met the FCC limits (i.e. 75 mW), as AirCell uses at its other sites.

[31] AirCell and V-COMM discussed this issue at the time it occurred. V-COMM indicated to AirCell that Cingular inadvertently set the DPC boost parameter for a single day of flight tests. V-COMM also indicated to AirCell that this day of flight tests would be removed from the results, and would be performed again without the "DPC Boost" setting. Further, AirCell can verify that the "DPC boost" parameter did not impact V-COMM's flight test results as submitted to the FCC, from the Figures 3.3-A to F and Figures 9.6-A through 9.8-CC of V-COMM's "Engineering Report of the AirCell Compatibility Test". From these figures, it is apparent that the AirCell

Nevertheless, with knowledge of these facts, AirCell uses this issue in attempts to characterize the V-COMM flight tests as being conducted on an AirCell site with incorrect settings. As explained above, this is not the case. V-COMM diligently corrected the issue and the flight tests submitted to the FCC are representative of AirCell base stations as optimized and configured by AirCell and in accordance with AirCell standards.

AirCell Assertion

5. AirCell indicated that handoffs were not configured for the Marlboro AirCell site for the V-COMM flight tests with DPC enabled, and this causes the flight test results to be unrepresentative of the AirCell network.

AirCell coordinated with Cingular's performance staff to set, configure and optimize all of the base site parameters prior to the Marlboro site going into commercial service, about 4 years ago. At that time, AirCell choose not to setup the handoffs for this site to any other of its neighboring sites. AirCell completed its optimization along with its necessary flight tests to ensure the Marlboro site was configured and operating in accordance with AirCell standards. AirCell conveyed to V-COMM the fact that the Marlboro site was optimized and was performing satisfactorily, at which time V-COMM subsequently performed the planned flight tests. During the time the V-COMM testing was performed, AirCell did not indicate that such handoffs were necessary for its standard operation nor required for this site. AirCell was fully aware of V-COMM's plans to perform such tests with the Marlboro AirCell site. Even if handoffs were configured for the Marlboro site it would not have impacted or altered the measurement data collected for V-COMM's straight-line flight tests as explained in more detail below.

It should also be noted that AirCell sites are frequently located in non-adjacent cellular markets, and because of this AirCell would not logically operate handoffs to many of its cell sites due to the high costs associated with leasing 160 to 200 mile facilities for voice links. The terrestrial cellular networks do not typically utilize handoffs between cell sites that are located in non-adjacent markets and therefore do not provide trunking between these mobile switches. In order to support handoffs, long leased trunk lines are normally required for voice channel traffic paths. Typically, these would be dedicated trunk lines. They can also require dedicated IS41 links for handoff messaging and separate trunk links for the voice path to handoff. These links may be in addition to the operator's IS41 or SS7 links that are used for call delivery. Since the terrestrial markets do not normally maintain these long leased trunk lines for handoffs between non-adjacent markets, this would be a significant operating expenditure. With AirCell's

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mobile DPC level never reaches the DPC level 2, which would have indicated DPC Boost was active. (AirCell configured its Marlboro site for a maximum DPC level of 3, which is equivalent to approximately 30 mW for mobile transmit power. The DPC Level 2 is equivalent to the 75 mW level, which is configured by AirCell for its other sites and permitted by current FCC waiver limitations.) Hence, all of V-COMM's flight test results that were submitted to the FCC for the "DPC Enabled" tests, utilized DPC settings that were set according to AirCell standards, as optimized by AirCell in flight tests conducted on the Marlboro AirCell site.

average traffic levels per base station at 2 to 3 minutes per day, the cost of these long lease lines for handoffs would appear to be a non-economical proposition. Based on the above, it is questionable whether handoffs are configured at many AirCell sites.

In addition, it should be pointed out that if handoffs were configured and operating for V-COMM flight tests, it would have little impact on the overall results. The Marlboro AirCell site would have served the airborne AirCell mobile for most of the Straight-line flight path, since it was the closest AirCell site to the flight path. Also, the handoff hysteresis function biases the call to remain on the serving site until a handoff candidate site received the signal level between 2 to 4 times as strong as the serving site. Only in the southern portion of the flight plan does the AirCell Ellendale, DE site serve the mobile. In the southern area of the flight pattern, between the Sea Isle VOR and Modena VOR, the AirCell airborne call was not served by the Marlboro site and was actually served by the Ellendale AirCell site on a different voice channel than measurements were being made at the 3 terrestrial cell sites. Only one voice channel from the Marlboro site was used for measurements at the terrestrial cell sites. So, the results submitted to the FCC did not include measurements from channels served by the Ellendale AirCell site, and only included measurements from calls served by the Marlboro AirCell site.

In addition, for the portion of the flight plan that flew in the southern direction away from the Marlboro AirCell site (toward Sea Isle VOR & AirCell Ellendale site), the AirCell service area extended to about 80 miles or less from Marlboro site.[32] The 80 mile service area is typical for AirCell service areas for most of its sites across the U.S. AirCell refers to its cell site service radius as typically between 80 to 90 miles. Therefore, these distances from the serving Marlboro AirCell site are representative of normal operating conditions within the AirCell network. For these reasons, the handoff configuration of the AirCell network would not have had a significant impact to the V-COMM flight test results.

AirCell Assertion

6. AirCell indicated that two of the three AirCell mobile phones were not formally inspected and checked by AirCell.

V-COMM Response: Prior to flight tests and while V-COMM was reviewing its flight test plans with AirCell, V-COMM had requested that AirCell verify the mobile phones utilized for flight tests met AirCell standards. AirCell fully agreed to perform this verification on all mobile phones utilized in V-COMM flight tests; however, AirCell only verified the installation in the Navajo twin-engine piston aircraft, which was utilized for flight testing at 10,000 feet and below. V-COMM made repeated requests for AirCell to inspect the other two aircraft as well, the King Air and the Learjet, but AirCell neither kept its initial commitment to V-COMM nor later provided such cooperation. So, it should be stated

[32] This was the case for all altitudes flight tests except the 10,000-foot altitude test, where the service area extended to 88 miles from the Marlboro site.

for the record that V-COMM made all attempts to have these installations approved by AirCell, and AirCell was the unwilling party in this matter.

Furthermore, the installations of the AirCell phone equipment in all three aircraft used for V-COMM flight tests were performed at factory authorized AirCell installation facilities that are strictly controlled by AirCell. AirCell provides training and specific installation instructions to these facilities to ensure proper installation for each aircraft. This ensures that each installation is in accordance with AirCell standards. Should AirCell believe that the installations at one of its authorized installation facilities are not in accordance with its standards, AirCell should provide such evidence to the FCC.

More importantly, AirCell should state for the record that the appropriate and correct AirCell mobile antenna type was utilized for the aircraft types utilized in the V-COMM flight tests. The belly-mounted antenna was used on the King Air and Learjet, and the VOR style antenna was used on the Navajo piston aircraft, as per AirCell specifications.

Lastly, the jet aircraft was flown at similar altitudes as the piston aircraft in the V-COMM flight tests (10,000 feet in DPC disabled tests, and 5,000 and 10,000 feet in DPC Enabled tests) and the tests show similar results for both aircraft. Consequently, the AirCell mobile phones installed in the jet aircraft are operating similarly to the phone installed in the piston aircraft, which was formally inspected by AirCell. In addition, based upon observations of the flight test results, there is *no* reason to suspect that the phones in both jet aircraft were not operating properly.

AirCell Assertion

7. AirCell indicated that some measurements at the Oak Hill site defy free space propagation characteristics for reasons that the measurement equipment was either not accurate or had a higher noise floor than other test receivers used at the two other terrestrial cell sites utilized in Phase 1 flight tests.

V-COMM Response: The cause is the latter reason provided by AirCell. AirCell provided the answer to its own issue. V-COMM's report provides the signal levels received at the test receivers for the three terrestrial cell sites utilized in flight tests, and the receiver utilized at the Oak Hill cell site is not as sensitive as the other two receivers utilized for the Marlboro and Swainton terrestrial cell sites.

In addition, as stated within the V-COMM Engineering Report, the co-channels and adjacent channels were cleared within the terrestrial cellular market during flight tests, and thus the measurements at the three terrestrial victim sites only include the intended AirCell signal levels.

AirCell Assertion

8. AirCell indicated that terrestrial cell sites selected for Phase 1 Flight Tests were not representative of typical sites with sector antennas down-tilted.

Phase 1 flight tests occurred in the Cingular market with three terrestrial cell sites that were within suburban and rural market environments. The Marlboro and Oak Hill cell sites are in suburban market environments, and the Swainton cell site is within a rural market environment. At the Marlboro site, four test antennas were installed for Phase 1 flight testing to measure the received AirCell signals on vertical, horizontal, and slant 45 polarities. These test antennas were installed just below the carrier's terrestrial antennas on the Marlboro tower. The Swainton and Oak Hill antenna systems were utilized just as they are normally configured for the carrier's wireless operation; they were not modified in anyway. The Swainton cell site is within a rural environment, and typically rural sites do not have antennas down-tilted. The Oak Hill cell site is within a suburban environment, and its antennas are approximately 50 feet above ground level. With this low ground elevation, suburban terrestrial cell sites typically are not down-tilted. Also, in comparison to the Verizon Wireless suburban and rural cell sites utilized in the AMPS Noise Floor Study, most of these cell sites do not have down-tilting (7 of the 10). And, within the Cingular Wireless network at the time of flight testing, approximately 66% of the cell sites did not have antennas down-tilted in these market areas. Thus, AirCell's assertion that the terrestrial cell sites utilized in V-COMM flight tests are not representative of typical sites with antenna down-tilting is not an accurate statement. As provided, the majority of the cell sites in Cingular Wireless' network do not have down-tilted antennas.

Also, it should be noted that AirCell service, as the secondary service in the cellular spectrum band, is not permitted to cause harmful interference to the terrestrial system, which has a significant number of antennas that are not down-tilted. These antennas are pointed with their maximum gain patterns to the horizon. This is common practice by radio engineers in optimizing the coverage of their wireless networks, by directing the maximum gain where its most needed, which is to the edge of the cell site's coverage area.

4.1 AirCell agrees with results of the Arc Pattern Flight Tests

Within the AirCell Engineering Report,[33] AirCell agrees with the signal strength results of the arc pattern flights used within V-COMM's AirCell compatibility flight tests. AirCell indicated that "the average signal levels measured by AirCell in 1997 [for its flight with DPC disabled] compare with the V-Comm measured levels within an average of 0.17 dB when similar test conditions are compared."[34] <u>Therefore, the Commission should recognize there is no dispute regarding the signal strength results of the arc-pattern</u>

[33] AirCell analyzes V-COMM's arc pattern flight tests in Section 2.3.c of the AirCell Engineering Report.

[34] With comparisons to its previous 1997 flight tests, AirCell agrees with the results of V-COMM's arc pattern flight tests performed at the fixed DPC level of 2 (equivalent to the 75 mW transmit power level). In Table 2.3.c.1 within its Reply, AirCell computes the "Total Average Difference" between AirCell's 1997 flight and V-COMM's flight as 0.17 dB.

flight tests (performed with DPC disabled). These results can be used to study the compatibility to the terrestrial networks with an AirCell mobile operating at its maximum power level, and they are utilized to characterize the path loss component in V-COMM's Case Study analysis.

Consequently, the signal strength results of V-COMM's arc flight tests are valid. These are the received AirCell signal levels for the Marlboro site using the arc flight pattern. These flight tests are not affected by its dynamic power levels or antenna configuration, since it was performed with the AirCell airborne mobile fixed at its maximum power level (DPC step 2, or the 75 mW level).[35]

The results of these tests provide useful insight as to the AirCell interference levels received at terrestrial cell sites. They represent the *actual* AirCell signal levels for the following circumstances:

1.) AirCell mobile phones operating at their maximum transmit power level on AMPS voice channels. The voice channel is utilized during active calls. The maximum AirCell power level is attained when the AirCell mobiles are furthest from their serving site, and closer to neighboring terrestrial cellular markets. Under these conditions, the AirCell system is most likely to cause harmful interference to the terrestrial network.[36]
2.) If and when handoffs are configured, AirCell mobile phones can operate at their maximum transmit power levels on voice channels prior to handoffs occurring between sites.[37]
3.) AirCell mobile phones operating at their maximum transmit power level on AirCell's non-standard control channels (terrestrial system voice channels). These transmissions are utilized for call setup and for autonomous registration of all mobile phones at periodic intervals. These transmissions are not controlled by the DPC algorithm of the AirCell site, and operate at the mobile phone's maximum power setting.

[35] The 75 mW transmit power level for AirCell phones is the maximum power utilized by many AirCell base sites in the country, and it is the maximum power level permitted by FCC waiver limitations. AirCell configured the maximum phone power level at its Marlboro base site to 4 dB lower than 75 mW, which was the DPC level of 3, or about 30 mW.

[36] The AirCell system utilizes a DPC algorithm that compensates for an increased path loss between its mobiles and serving sites by increasing the transmit power of its mobile phones. Consequently, when AirCell mobiles are furthest from their serving sites, AirCell's DPC algorithm instructs their mobiles to power-up to their maximum power levels to overcome the increased path loss and to maintain the call on the AirCell network.

[37] During these circumstances, AirCell mobiles can operate at their maximum power levels. In addition to the increased path loss from its serving site, handoffs require a hysteresis margin to prevent 'ping-pong' handoffs (calls are biased to the serving site to prevent a call from 'handing off' back and forth between sites). These two issues cause AirCell mobiles to power-up to overcome the increased path loss and handoff hysteresis margin.

These results also allow us to understand the signal propagation loss (“path loss”) between the AirCell airborne mobiles and terrestrial cell sites. With this path loss data, further analyses can be performed. V-COMM utilized the “path loss” component from these test results in a Case Study that analyzes and assesses the compatibility of the AirCell system with the terrestrial cellular networks.

Also, the results of the arc flight tests are used to determine the maximum range of AirCell signal levels to inject into terrestrial sites for V-COMM’s Phase 2 interference tests with AMPS, TDMA & CDMA technology. The results of the arc pattern flight tests included the received AirCell signal strengths from the noise floor of the terrestrial cell site up to –72 dBm, as referenced to the cell site input. The flights were conducted on arc patterns that are 2, 5, 10, 20, 40 and 80 miles from the AirCell serving site, at flight elevations at 2,000, 5,000, 10,000, 20,000 and 35,000 feet.

5 V-COMM's System Compatibility Interference Tests

Within its Reply and Engineering Report, AirCell provided several criticisms regarding the test plan and results of V-COMM's System Compatibility Interference Tests. Within V-COMM's AirCell Compatibility Test Plan, these tests are referred to as Phase 2 Interference tests with AMPS, TDMA and CDMA technology. As stated in V-COMM's Reports, these interference tests were performed at a typical suburban terrestrial cell site, which was configured and operating normally. The site was representative of a typical suburban site, and was operating with the same standard and normal settings as other cellular sites operate with in the surrounding market area and other areas within the country. These tests were utilized to characterize the impact of the AirCell system interference levels to the terrestrial networks. AirCell's criticisms are addressed below and are inaccurate statements regarding the interference tests that are conducted in cooperation with participating carriers and with the supervision of Lucent Technologies, the manufacturer of base station equipment utilized in this market area. Further, AirCell makes several criticisms that challenge the integrity of the V-COMM engineering team, the carriers and Lucent Technologies. These are also inaccurate statements, which attempt to discredit the validity of V-COMM's interference tests, and are addressed below.

The assertions provided by AirCell in its Engineering Report regarding V-COMM's System Compatibility Interference Tests are as follows:

1. The measurement of the noise plus interference for the phase 2 tests was improperly conducted and resulted in erroneous values of operating points.

2. The flight tests were conducted with an improperly configured AirCell serving site, resulting in uncharacteristically high values of incident signals into terrestrial sites, which were then used in the phase 2 analysis.

3. The phase 2 tests were based upon the extrapolations of the results of items 1 and 2 above, as well as using a non-representative cell site configuration.

4. The experimental approach to phase 2 contains many flawed analytical techniques.

5. The case study presented by V-COMM incorporated these incorrect operating points and incident signal levels, and presented erroneous conclusions about the effects of the AirCell system's impact to terrestrial networks.

These assertions are provided within section 2.4 of AirCell's "Engineering Review of V-COMM Reports" document, which contains 25 pages of analyses and statements within its engineering review report. These issues are addressed below (and also in other sections of this report), and should be discarded as inaccurate statements relating to V-COMM's System Compatibility Interference Tests.

AirCell Assertion

1. The measurement of the noise plus interference for the phase 2 tests was improperly conducted and resulted in erroneous values of operating points.

V-COMM's measurement of the system noise plus interference was properly conducted, and a detailed description of these tests is provided in V-COMM's "Engineering Report of the AirCell Compatibility Tests"; the tests used methods similar to those used in V-COMM's AMPS Noise Floor Study. These methods are accepted standard engineering practices used by carriers, Lucent, other engineering companies, and also AirCell and its engineering consultant, WSE. AirCell does not indicate how this measurement has a bearing on the results of the Phase 2 interference tests, but merely throws this issue onto the table along with other issues that are also unsupported and inaccurate.

AirCell Assertion

2. The flight tests were conducted with an improperly configured AirCell serving site, resulting in uncharacteristically high values of incident signals into terrestrial sites, which were then used in the phase 2 analysis.

As described in Section 4 of this document, the AirCell serving site used in the V-COMM flight tests was configured and optimized by AirCell and is representative of this site and other AirCell sites around the country. Further, the airborne mobile units were installed at certified AirCell installation facilities, which adhere to installation standards set by AirCell. In addition, AirCell mislabels their base site antennas on their installation photograph for the Marlboro site, which only serves to mislead the Commission into believing that its receive antennas are mounted inverted, and into the tree line. As explained in section 4 of this report, these AirCell statements relating to the V-COMM flight tests are not accurate, and mischaracterize the V-COMM flight tests.

Similar to the previous assertion, AirCell does not draw a connection regarding what impact V-COMM's flight tests would have in relation to V-COMM's compatibility interference tests. The V-COMM compatibility interference tests were performed in separate tests, and as such, have no direct bearing on the flight tests.[38] Since these were independent tests, the order of occurrence is not germane to the development of the data and to the determination of the impact of interference on terrestrial cellular systems.

[38] The only impact that the flight tests had on the interference tests was to establish the highest level of injected AirCell signals into the terrestrial cell site. V-COMM interference tests utilized simulated AirCell signals levels that were injected into the terrestrial cell site at incremental levels up to the highest level recorded in the flight tests, which was –72 dBm referenced to the terrestrial site's input port.

AirCell Assertion

3. The phase 2 drive tests were based upon the extrapolations of the results of items 1 and 2 above, as well as using a non-representative cell site configuration.

As explained above, the two previous items do not have a bearing on the results of the phase 2 interference tests. The interference tests were conducted in separate tests, which accordingly stand on their own. There were no “extrapolations” of previous test results that contributed to impacting the results of the interference tests. Again, the interference tests could have been conducted first, and the same results would have occurred. AirCell has made this flawed statement a third time within its section 2.4.

As stated previously within V-COMM’s Reports, these interference tests were performed with a typical suburban terrestrial site that was configured and operating normally.[39] The site was representative of a typical suburban site, and was operating with same standard and normal settings as other cellular sites operate within the surrounding market area and other areas around the country. These tests were utilized to characterize the impact of the AirCell system interference levels to the terrestrial networks. AirCell’s criticisms in this respect are unfounded and inaccurate.

The Ewingville site was selected as a representative suburban site. In contrast to AirCell’s allegations, V-COMM did not modify the Ewingville site settings in order to skew the results of the interference tests. AirCell’s allegation is blatantly incorrect and inaccurate. AirCell’s entire justification for its Section 2.4 of its Engineering Report centers on the allegation that the Ewingville site was deceitfully re-configured to skew the results. This is absolutely not true. This site was chosen because its operating levels were representative of other suburban sites and no re-configuration was performed by either V-COMM or the carrier to skew the results of these tests.

In fact, the median operating noise floor level for all suburban and rural sites (and also thirteen of the eighteen sites) within V-COMM’s AMPS Noise Floor Study was –127 dBm, which is the same for Ewingville site. The Ewingville noise floor results graph compares very closely to the five other suburban sites in the AMPS Noise Floor Study. Actually, the Ewingville site is one of the “noisier” sites of the suburban sites tested, 4 of the 5 AMPS sites had lower noise levels than Ewingville site.[40] Consequently, AirCell’s assertion that the site is not representative of other suburban sites it not correct.

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[39] The cell site’s configuration, settings, and operation were not modified for these tests, as AirCell suggests in its Reply, but they are in accordance with the carrier’s settings, the carrier’s and vendor’s standards, and the same settings as other suburban sites in their cellular networks.

[40] Four of the five suburban sites included in the AMPS Noise Floor Study exhibited higher probabilities of occurrence for operating noise levels at the lowest noise floor level (greater likelihood of a quieter noise floor condition). Also, three of the five suburban sites exhibited greater likelihood of the lower noise floor conditions existing in the two lowest noise floor bins.

In addition, within its Engineering Report, AirCell analyzes the Ewingville site's call signal levels and the Mean Opinion Audio Quality Score (MOS) readings from V-COMM's interference tests to support its claims that the Ewingville site is not representative of a typically operating suburban site. These analyses are also flawed for the following reasons.

In these analyses, AirCell reviews the Ewingville site's call signal levels and erroneously infers the site's operating setting for its dynamic power control (DPC) box. Further, AirCell adds that the cell equipment manufacturer's standard guidelines (from Lucent documentation) state that the operating signal levels for the target DPC value is –90 dBm on average, as referenced to the cell site input port. With these statements, and analyses of the 50% median of the call signal level data, AirCell concludes that the Ewingville site must be configured to 10 to 15 dB abnormally lower than nominal Lucent settings, and thus the site is not representative of a typical site's operating parameters. These analyses given by AirCell in its Engineering Report are flawed for the following reasons.

First, the Ewingville cell site's operating parameters were typical and the same as other sites in Verizon Wireless' and Cingular Wireless' cellular networks. V-COMM confirmed this fact with the licensed carriers' engineering staff, and reviewed the operating signal levels for the Ewingville site, as well as other cell sites within their network. The carrier's provided that almost all of their sites are similarly configured with the same operating settings. For AMPS and TDMA technology sites, the Ewingville site was configured with a <u>target DPC setting of –90 dBm, which was **exactly** equal to the average value of Lucent's nominal range</u>, as given by AirCell in its Engineering Report.[41] For the CDMA technology site, the Ewingville site was also configured according to vendor guidelines with standard thresholds for target EbNo and error rate parameters. Thus, according to AirCell's statements of the normal operating signal settings, AirCell must *now* agree that the operating settings for the Ewingville cell site was in fact <u>normal and typical</u>.

Second, AirCell erroneously and mistakenly estimates the target DPC value of the Ewingville site as the 50% median level of the site's call signal data. AirCell's analysis is flawed for the following reason. When AMPS & TDMA phones are already transmitting at their maximum power, due to increased path loss from the clutter of the environment, increased distances from the serving cell site, and/or cellular phone use within buildings, it cannot simply increase their power to operate within the cell site power box settings. Since these mobiles are already at maximum power their signals may fall below the cell site's power box settings; however, these phones will still continue to hold the call. This is a typical occurrence in terrestrial cellular networks, and is completely overlooked by AirCell in its analyses. Thus, AirCell's analysis of estimating the target DPC value for the Ewingville site is flawed and inaccurate. As

[41] The Ewingville site was collocated with Verizon Wireless' & Cingular Wireless' terrestrial cell site. The Verizon Wireless site provided service with CDMA & AMPS technology, and the Cingular Wireless site provided service with TDMA technology.

stated above, the actual DPC operating settings for the Ewingville site were standard and typical, and are within Lucent's nominal ranges.

Third, AirCell's observations include that some customer calls were carried to substantially lower levels, i.e. within levels of –124 dBm. However, it should be noted that some of the lowest signal levels recorded by the cell site's PLM mode 1 function,[42] are not necessarily the active call signal measurements, and only represent the interference plus noise levels on the channel. This occurs in the following circumstances: 1.) the cellular subscriber's phone battery dies during an phone conversation; 2.) the cellular subscriber terminates the call with the phone's power-off button rather than its 'end' call button; and 3.) the subscriber experienced increased path loss by moving further into areas with poor cellular coverage (i.e. further within a building) and drops the call as a result of a poor handoff or inadequate signal strength. In these three circumstances, the cell site continues to perform its PLM mode 1 measurements on the channel for up to 20 seconds after the call has actually ended by the cellular subscriber party. In these circumstances, the cell site does not have perfect knowledge of the status of the call, and considers the measurements on the channel as representing active calls when it actually represents the interference noise floor for these short periods of time. Hence, AirCell's consideration of the lowest call signal levels is not valid, as they are likely measurements of noise rather than active calls on the channel.

AirCell also hypothesizes that V-COMM's drive route does not capture the lower call signal levels from the cellular subscriber call signal data for the Ewingville site, for reasons that the drive route did not fully extend to outer serving areas of the cell site. This statement is also not true. AirCell incorrectly estimates the coverage radius of the Ewingville cell site to 2.25 to 2.5 miles. The correct analysis of the midway point of the Ewingville site serving area to its surrounding cell sites is as follows. The surrounding cell sites are 3.1, 3.3, and 3.6 miles apart, and the halfway points are 1.55, 1.65, and 1.8 miles, respectively. And, the other three surrounding sites had antenna elevations that were higher than the Ewingville site, which made their serving areas slightly larger. The V-COMM drive test included the outer most serving area of the Ewingville cell site, which was 1.5 miles away from the site. The V-COMM drive route did not match the lowest call signal levels of cellular customers for reasons that many customers use cell phones in-buildings with significant building attenuation. V-COMM's drive route does not match the lowest signal levels that occurred on the site, but the drive route very closely matches the other portions of the customer call signal levels.[43]

[42] Lucent cell site equipment is able to utilize its Power Level Measurement (PLM) function to measure the signal levels of active calls with the cell site receiver.

[43] In comparison of the cumulative histogram data for the customer signal levels and V-COMM's drive route signal levels, these two curves very closely match each other. The only exception is the lowest region of the curve, where cellular customers are received at very low levels due to in-building cellular phone usage.

Fourth, AirCell provides an analysis of the MOS readings from V-COMM's interference tests to support its claims that the Ewingville site is not operating properly. Again, this analysis is flawed and not true. As stated above, the Ewingville site was operating properly, and in accordance to the vendor's standards. Based upon the results of the V-COMM interference tests with AMPS technology, the MOS readings for the base line test with no injected interference was 3.3, with a median carrier to interference (C/I) ratio of 30 dB, and a 90% C/I ratio of 20 dB. These operating levels are acceptable and in the 'good' audio quality range for AMPS cell sites. For the Ewingville TDMA site, the base line MOS was 3.6, the BER was 0.1%, the median C/I level was 25 dB, and 90% C/I was 15 dB. The performance for the TDMA site was also in the 'good' quality range for MOS readings, which is within the MOS range of 3.25 to 3.75.[44] Therefore, AirCell's analyses regarding the performance of the Ewingville site as measured in V-COMM's drive tests are not accurate.

Illogically, after AirCell uses the MOS results of the Ewingville site to make its assertion, AirCell states that MOS is an unreliable measurement of audio quality. Neither V-COMM nor others in the wireless industry, agrees with AirCell's assessment of MOS. MOS is the standard for audio quality measurements for digital and analog technologies. Comarco drive test equipment was utilized in V-COMM's interference drive testing, which represents one of the more advanced drive test equipment offered to the cellular industry. The development and implementation of the MOS measurements required significant efforts from the equipment vendors, and have been verified by independent engineering studies to be accurate and representative of customer's mean opinion survey scores. The results of these MOS studies do not agree with AirCell's statements within its Engineering Report concerning the validity of MOS.

Therefore, as explained above, the V-COMM system compatibility interference tests are valid and representative of a typically configured and operating suburban terrestrial cell site. AirCell's assertions in this respect are inaccurate, and rely upon numerous flawed analyses.

AirCell Assertion

4. The experimental approach to phase 2 contains many flawed analytical techniques.

AirCell argues against using drive tests to measure the impact of the AirCell interfering signals to the terrestrial networks, since it claims it results in uncontrolled variables: namely the interference noise environment and loading of traffic on the network. It prefers the laboratory environment testing it undertook, over tests in a real operating network. In preparing for the phase 2 testing, careful consideration went into driving the exact same roads with consistent speeds, and the noise environment and traffic levels were observed to be similarly consistent during the testing periods, which was very

[44] The 'good' quality MOS range (3.25 to 3.75) is the typical performance range for cellular calls. The 'excellent' audio quality MOS range (3.75 to 5.0) is typical for landline calls.

good for repeatable results. We reviewed customer traffic data for the test site, which had similarly consistent loading levels for the testing period between 9 am and 3 pm. Therefore, the drive testing, traffic loading, and noise environment was consistent, and allowed for repeatable results. This is observed in the data.

In its Engineering Report, AirCell refers to single metrics without looking at the entire results of the testing. As the interference increases above levels where harmful interference is already indicated in the results, single metrics may be affected in different ways. For example, the MOS or dropped call metrics may appear slightly out of trend for single test results, when actually more calls are being blocked during these drive tests resulting in reduced coverage areas that serve calls along the drive route. At the increased interference levels, the impact of the AirCell interference prevents establishing and maintaining calls for much of the serving area of the terrestrial cell site.

Also, the measurement interval for some metrics may be slightly larger than other metrics, which results in slightly more variability in the results. V-COMM's interference compatibility drive tests included many metrics to measure the entire impact to performance of the cell site. These tests include the following ten performance metrics: Dropped and Blocked Calls, Mean Opinion Audio Quality Score (MOS), Digital Error Rates, Carrier to Interference Ratios, Loss in Capacity, Minutes of Use, Mobile Transmit Power & Energy per Bit Noise Levels, and Overflowed Call for CDMA.

Therefore, AirCell's assertions are incorrect. The results of the V-COMM interference tests exhibited repeatable and consistent results, and the entire data set of metrics need to be reviewed in consideration of the level in which AirCell signals cause harmful interference to the terrestrial network.

AirCell Assertion

5. The case study presented by V-COMM incorporated these incorrect operating points and incident signal levels, and presented erroneous conclusions about the effects of the AirCell system's impact to terrestrial networks.

The case study was an accurate method to model the impacts of AirCell airborne signals on terrestrial cellular systems. The data used for the study was accurate and representative as outlined above. The case study is further described in section 6 of this document. The case study does not effect the results of the phase 2 tests; rather the results of the phase 2 tests are inputs into the case study.

6 Case Study & Interference Assessment

Included in Section 2.5 of AirCell's Engineering Report were several criticisms of the Case Study and Interference Assessment developed by V-COMM. These criticisms are addressed below and can be dismissed as unfounded and inaccurate statements, used in an effort to discredit V-COMM's methodology and draw focus away from AirCell's own flawed analyses.[45]

In the introductory paragraphs of the Executive Summary (Section 1.0) of the AirCell Engineering Report, AirCell stated that it is processing over 30,000 minutes per month, servicing 1400 aircraft.[46] These numbers are relatively small in comparison to the 150 million terrestrial cellular subscribers processing tens of billions of minutes per month. Because of the great difference in subscriber bases (airborne vs. terrestrial), the speed at which the airborne subscribers travel, and the limitations of cellular system detection tools,[47] it is impossible to trace interference complaints even though harmful interference is present.

V-COMM developed a case study to model the effects of interference from airborne subscribers to terrestrial subscribers by using the controlled test data from its flight tests and cross-interference tests to accurately depict the potential extent of interference that can be expected from airborne units. This model is a valid and sound approach to depict the true effects of harmful interference that can exist if AirCell continues to operate under its current waiver and its subscriber base continues to grow.

[45] AirCell's interference assessment draws from its extremely limited flight tests (solely representing the "best case" flight path over a terrestrial victim site), invalid interference compatibility tests using inappropriately high noise floor levels that mask the true effects of the interference, and statistical probability analyses intended to further dilute the true impact of harmful interference that is generated by AirCell's operations.

[46] 30,000 minutes of traffic per month represents levels that are 2.5 times higher than observed by V-COMM for five AirCell sites in the northeast, and traffic levels provided by AirCell in its petition for waiver extension. From these previous reports, the average traffic levels were approximately 3 minutes per day, per site. With 135 AirCell sites in-service, this represents approximately 12,000 minutes per month, which is 2.5 times lower than the 30,000 minutes. AirCell does not state whether the 30,000 minutes of traffic includes traffic from its satellite based service in addition to its cellular-based service, or whether AirCell is using a different method to estimate its system traffic (i.e. using peak rather than average levels to estimate traffic levels).

[47] V-COMM provides an extensive explanation regarding the limitations of cellular provider's system tools in Section 9.2 "Cellular Switch-based Interference Detection Tools Are Not A Feasible Method For Measuring Potential Interference From AirCell Transmissions" of V-COMM's "Engineering Report of the AirCell Compatibility Test" (filed 4/10/03).

AirCell's assertions in its Engineering Report concerning V-COMM's Case Study and Interference Assessment are summarized below.

1. AirCell has validated its system does not interference with terrestrial systems with supporting data provided by two sources that are not submitted to the FCC for review. These two sources included: a.) a sophisticated mathematical propagation tool that models the signal levels from airborne AirCell mobiles, and b.) test data from flight tests performed on the AirCell network representing close to a million miles of flight testing.

2. The *noise floor* used by V-COMM to build its case is only the thermal noise of the system and not the noise plus interference. The noise floor values re-cast by AirCell show the noise floor elevated by as much as 15 dB above the actual measurements.

3. The interference levels from the noise measurements re-cast by AirCell show that they are HIGHER than the median AirCell signals measured in flight tests.

4. V-COMM's flight tests used a variety of "biased" conditions that grossly distort the level and distribution of reported received AirCell signals.

5. V-COMM's utilization of a test site for its cross-interference tests with AMPS technology appear to be based upon a unique cell site configuration and not a typical operation.

6. V-COMM's flight tests utilized a Bow Tie flight route to maximize the distance to the Marlboro site when near victim sites.

7. AirCell has additional sites in service within the vicinity of the Marlboro service area, and now a small portion of the "Bow Tie" route is actually within closer range to a new AirCell cell site.

8. The V-COMM case study flight route maintains a flight track as far from serving AirCell sites as possible.

9. Handoffs were not implemented at the AirCell Marlboro site despite requests by AirCell to Cingular.

AirCell Assertion

1. AirCell has validated its system does not interference with terrestrial systems with supporting data provided by two sources that are not submitted to the FCC for review. These two sources included: a.) a sophisticated mathematical propagation tool that models the signal levels from airborne AirCell mobiles, and b.) test data from flight tests performed on the AirCell network representing close to a million miles of flight testing.

In order to provide comments or form an opinion regarding the credibility and validity of these two sources of supportive material to which AirCell is referring, it must first submit them into the public record. If AirCell believes such sources to be valuable data to support its non-interference claims, it should submit them to the FCC. AirCell must do more than just convince itself that its system does not cause harmful interference. As that is exactly what it is doing by conducting tests and reviewing supportive data in secrecy. <u>Its burden as a secondary service provider in the cellular spectrum requires that it share such types of data and provide such evidence of non-interference.</u>

AirCell has not produced this model for review to the opposing carriers or the FCC. In fact, the statistical probability analysis that has been submitted to date is based upon a single day of flight testing representing approximately 850 miles of flight tests from 1997 with only 1 of the 2 types of aircraft antennas that AirCell offers today.[48]

In contrast, V-COMM has flown over 10,000 miles in flight tests to genuinely collect data which can be used to represent the true impact of AirCell's subscriber base and the further impact of its growth as it relates to terrestrial service. V-COMM has submitted the results of these flight tests to the FCC for review and consideration.

AirCell Assertion

2. The *noise floor* used by V-COMM to build its case is only the thermal noise of the system and not the noise plus interference. The noise floor values re-cast by AirCell show the noise floor elevated by as much as 15 dB above the actual measurements.

This is AirCell's first bullet point within its section that review's V-COMM's Case Study. Interestingly, however, the noise floor measurements performed by V-COMM in the AMPS Noise Floor Study does not have *any* bearing on the results of the Case Study. The AMPS Noise Floor Study was a study that was a completely separate study, from V-COMM's compatibility tests in relation to the AirCell system. V-COMM's Case Study uses empirical data from the flight tests and cross-interference tests from V-COMM's "AirCell Compatibility Test". Therefore, the results of the AMPS Nose Floor Study do not have any bearing on the results of the Case Study.

The issue regarding AirCell's invalid re-casting the of the AMPS noise floor measurements is explained in previous sections of this document, which also addresses other unfounded assertions made in AirCell's Reply Comments. While AirCell criticizes the V-COMM measurements and asserts that they are invalid, it is interesting to note that AirCell's own previous noise measurements are similar albeit lower that what V-COMM measured. AirCell is arbitrarily increasing the noise floor values above the actual measured data to support its claims of no interference. This methodology is described in great detail in Section 3 of this document.

[48] Their probability analyses are solely based on flight tests performed on July 10, 1997, which represents approximately 850 miles of flight test data.

AirCell Assertion

3. The interference levels from the noise measurements re-cast by AirCell show that they are HIGHER than the median AirCell signals measured in flight tests.

Once again, it should be noted that the AMPS Noise Floor Study results, also AirCell's re-casting of such data, do not have a bearing on the results of the Case Study. The Case Study utilized empirical data from V-COMM's flight tests and cross-interference tests, along with a particular flight path that has commercial and general aviation traffic greater than 113 flights daily, in either direction.[49] These areas contain two heavy usage General Aviation facilities, one of which is Teterboro; the largest General Aviation airport in New Jersey. Additionally, Washington, D.C. is the top destination for non-stop flights departing from NY/NJ area airports.

AirCell's point is out of correct context, and does not have a bearing on the Case Study. Furthermore, V-COMM's flight tests exhibited received signals, at the victim terrestrial site, from airborne AirCell units as high as –72 dBm with frequent received signals in the -90 dBm to -100 dBm range. Measurements from the AMPS Noise Floor Study are much lower than these levels, and are closer to the range from -123 dBm to -127 dBm. If the actual measurements are superimposed on the same chart, the AirCell signal levels are received at significantly higher values.

AirCell Assertion

4. V-COMM's flight tests used a variety of "biased" conditions that grossly distort the level and distribution of reported received AirCell signals.

The flight tests utilized AirCell's DPC function in both enabled and disabled states. The enabled state allows us to determine the different DPC levels that can be expected at various locations along typical flight routes in the serving area of the AirCell Marlboro base site. When DPC was disabled, the received airborne signals can be accurately measured without having to take into account a varying transmit power, thereby producing an accurate representation of the expected path loss with the AirCell mobile phone at its maximum power (75 mW). These results were then combined to model path loss plus power control so that an accurate representation of expected airborne signal strengths can be determined. <u>This modeling of the two conditions, path loss and power control, does not produce biased or worse case conditions but rather shows typical operating conditions for the AirCell system.</u>

[49] The flight profile used for the case study takes into consideration a flight between Dulles Airport, Washington, D.C. and Teterboro Airport in Teterboro, NJ. V-COMM researched actual flight plans between these destinations and verified the flight plan with local pilots. V-COMM also referred to pilot handbooks for typical ascent, descent, airspeed and landing statistics to utilize for this flight path profile. Therefore, this flight profile along this corridor represents a very typical profile and one that would likely be chosen by General Aviation as well as Commercial aircraft.

Further, the flight tests were conducted along typical flight corridors, following VOR navigational techniques and routes commonly flown in these parts of New Jersey, Pennsylvania, New York, and Connecticut. AirCell's assertions that conditions of the flight tests were biased thereby grossly distorting levels of received data are unfounded and should be dismissed. In fact, AirCell does not delineate these supposed biased conditions but merely throws the idea on the table to further stir things up.

AirCell Assertion

5. V-COMM's utilization of a test site for its cross-interference tests with AMPS technology appear to be based upon a unique cell site configuration and not a typical operation.

The AMPS terrestrial cell site used for evaluating the impact of AirCell transmissions is a typical suburban cell site with parameters consistent for cell sites in the surrounding market areas of New Jersey and Pennsylvania. They are also consistent with typical parameters utilized by other carriers in other markets across the country. In these markets, the carriers follow the vendor guidelines for network optimization and optimize their systems for performance. All evaluation methods were based on actual operating conditions existing at the cell site and are repeatable, consistent test methods. The subject cell is not unrepresentative, and was chosen for its standard configuration and operation.

AirCell claims it audited several of the sites in V-COMM's study, but as with other claims, does not provide backup data and information explaining its assertions. Therefore, these assertions are neither accurate nor sufficiently documented by AirCell, and should be dismissed as such.

AirCell Assertion

6. V-COMM's flight tests utilized a Bow Tie flight route to maximize the distance to the Marlboro site when near victim sites. The flight plan was difficult if not impossible to clear with the FAA.

The intent of the V-COMM tests was to fly two straight lines along typical flight routes both over and along side of the Marlboro AirCell site. Upon discussion with the FAA and local pilots it was determined that having these straight lines follow VOR points is easier to coordinate and replicate, and represents typical flight routes for the area. For this reason, the straight lines had slight augmentations in them. Since the airplane had to return back to the Marlboro area at some point in the route in order for the aircraft to complete the second straight-line pattern in the route, the two straight lines were capped at each end thereby constructing a flight route that resembles a bow tie. In general, the ends of the bow tie had no AirCell service and therefore, very little data was collected along these segments of the flight pattern. The distances flown and service ranges experienced were and still are typical for AirCell serving sites. AirCell also suggests that these tests and flight routes were not coordinated with the FAA, but in fact

V-COMM coordinated them with the FAA, and the FAA approved them. AirCell also asserts that these flight patterns were likely flown in short segments. This is not the case, as the bow-tie flight route is approximately 530 miles, and all three aircraft easily accomplished the entire route for each altitude flown.

AirCell Assertion

7. AirCell has additional sites in service within the vicinity of the Marlboro service area, and now a small portion of the "Bow Tie" route is actually within closer range to a new AirCell cell site.

The V-COMM flight tests were performed in the late 2000 – mid 2001 timeframe. At the time of the flight tests and the submittal to the FCC, AirCell only had the sites denoted in the V-COMM report that were providing service. There was never any mention of additional sites and it was not until recently in 2003, nearly two years later than the flight tests that AirCell installed an additional site in the area of the V-COMM test. The typical distance between other AirCell base sites around the U.S. is about 160 to 200 miles. AirCell has previously stated in the record that its base station's service radius is typically between 80 to 90 miles. These tests are valid for typical AirCell sites around the country as well as Marlboro. As mentioned in previous sections, the ends of the bow tie had little or no service and therefore little to no data was collected. Therefore, additional flying beyond the typical 80-90 mile radius had little impact on V-COMM's analysis.

Therefore, AirCell's statements should be dismissed. The V-COMM flight test results represent a typical AirCell cell site, as representative of other typical sites AirCell maintains across the country.

AirCell Assertion

8. The V-COMM case study flight route maintains a flight track as far from serving AirCell sites as possible.

As mentioned previously in this section, the flight route in the case study was selected to exemplify typical routes in this study corridor. They were verified to be consistent with typical flight trips along this path. It was not chosen to specifically influence results as AirCell has asserted throughout its report. The flight profile used for the case study takes into consideration a flight between Dulles Airport, Washington, D.C. and Teterboro Airport in Teterboro, NJ. The flight profile along this corridor represents a very typical profile and one that would be chosen by general aviation as well as commercial aviation aircraft.

Furthermore, with many AirCell sites located in rural areas, and a higher percentage of flights naturally traversing the more populated areas (i.e. within the major city areas), it stands to reason that *most* flight routes *in all parts of the country* would occur on tracks that are farther from AirCell sites.

Therefore these claims should be dismissed as an attempt by AirCell to fabricate doubt in the FCC's mind as to the genuine nature of the testing and analyses performed by V-COMM.

AirCell Assertion

9. Handoffs were not implemented at the AirCell Marlboro site despite requests by AirCell to Cingular.

As mentioned in previous sections of this document, AirCell optimized its Marlboro site prior to V-COMM's flight tests. AirCell did not request Cingular to configure handoffs, and did not state that they were necessary for the proper operation of their site. AirCell was fully aware of the flight tests that were to take place. Logically, it makes sense that handoffs would not be implemented among many of the AirCell sites as many of the sites are not in adjacent terrestrial networks and the costs involved in setting up trunks and data links for such little traffic demand (i.e. the handoff voice trunking requirements) would be cost prohibitive. This is explained in greater detail in previous sections of this document. Despite the economics, it should be noted that having handoffs implemented would have had little impact on the overall results, as the Marlboro site would still have been the primary serving site during the flight tests as described in Section 4 of this report.

In addition, with respect to the analyses in the Case Study, the closest AirCell site to the flight plan (DC to NJ) was chosen. As such, handoffs for the AirCell system are assumed to be occurring during this flight route. V-COMM stated this fact in the Case Study section of its report; accordingly, it represents a best-case scenario that is used in assessment of the interference from the AirCell system into terrestrial networks.

7 AirCell's 1997 Flight Tests and Cross-Interference Tests

Within its Engineering Report, AirCell provides additional information in efforts to support that its 1997 tests remain valid and continue to provide a foundation for its waiver and on-going operation of its air-to-ground network. However, the new information that AirCell provides does not support this conclusion, as explained below. Concerning their previous tests, AirCell makes the following claims and/or assertions:

1. AirCell has flown nearly a million miles of flight tests comprising of thousands of hours of data collection.
2. AirCell provides additional flight tests from 1998 and 2003 that affirm the 1997 flight data.
3. Statistical analysis of the new flight test data re-affirms the 1997 test results.

These assertions are provided within section 2.6 of AirCell's "Engineering Review of V-COMM Reports", and are examined further below.

In addition, further discussion points on AirCell's comments pertaining to terrestrial site noise floor levels and future digital technologies are provided below in sections 7.1 and 7.2, respectively.

Also, it is important to note that AirCell does not address many serious deficiencies and technical flaws as indicated by V-COMM in its "Engineering Response to AirCell's Petition for Waiver Extension." In this report, an extensive analysis of AirCell's previous 1997 flight tests and cross-technology interference tests was provided and submitted to the Commission.

AirCell Assertion

1. AirCell has flown nearly a million miles of flight tests comprising of thousands of hours of data collection.

AirCell reiterates this claim in support of its other assertions made within its Reply and accompanying Engineering Report as well, but it does not offer such data to support its assertions or conclusions. Again, as stated previously, it is only valuable if AirCell provides such data and evidence into the FCC record, for such data to be considered valid. Otherwise, AirCell is simply implying that 'its opinion' of non-interference is sufficiently meeting its burden of proof regarding operating pursuant to its waiver.

As stated previously, AirCell's conclusions of non-interference only rely upon 850 miles of flight tests conducted in 1997. Within its Engineering Report, AirCell adds two new flights totaling approximately 150 miles of new flight data. In contrast, V-COMM has flown over 10,000 miles in flight tests to genuinely collect data which can be used to represent the true impact of AirCell's subscriber base and the further impact of its growth as it relates to terrestrial service. V-COMM has submitted the results of flight tests to the FCC for review and consideration. V-COMM's flight data represents 10 times more flight data than AirCell's tests, includes a variety of flight orientations to serving & victim sites, a variety of both AirCell mobile antennas and typical terrestrial base station antennas, and many different flight altitudes. AirCell's flight tests includes a small subset of the V-COMM flight tests, and generally AirCell's fight tests are representative of the 'best case' flight test scenarios.[50]

AirCell's claim of flying nearly a million miles of flight tests comprising thousands of hours of data collection is possible, but AirCell offers only a small sample of new data and very little of the test plan details. In fact, the additional tests that are outlined in its Engineering Report account for approximately 150 miles, bringing the total reported AirCell testing to approximately 1,000 miles, or one tenth of one percent of the claimed million miles. AirCell appears to include this statement in its Reply Comments to convince the Commission that it continually performs flight tests in further support of its waiver, yet selectively chooses a miniscule sample of the data and provides partial details of these tests. If in fact AirCell has this data, it should provide it for the Commission, the carriers, and the public to review.

AirCell Assertion

2. AirCell provides additional flight tests from 1998 and 2003 that affirm the 1997 flight data.

AirCell has performed two additional flights in an effort to support its 1997 flight data. The new test data does not re-affirm the 1997 test results for the following reasons. First, AirCell does not supply much of the details of the test plan, which precludes the proper analysis of such data. Second, the two additional flights represent a paltry amount of new flight data; one of which was similar to previous tests it conducted. With this new data, AirCell has not provided any foundation that supports its assertion. AirCell's new flight data is examined below. The first flight was in 1998, and second was in 2003.

AirCell's flight test in 2003 attempts to compare two different aircraft antennas and conclude that the similarity of the data sets for this one flight orientation indicates that the antenna type does not affect the measured signals on the ground to any significant degree. The results are presented in Figure 2.6.b.0 of AirCell's Engineering Report and are reproduced below.

[50] AirCell's 1997 flight tests only include the airplane orientation directly toward or away from a victim site, and parallel (adjacent) to its serving site, thereby allowing its mobile to operate at lower DPC levels and be received at the terrestrial site at lower signal levels. Also, within its flight tests, AirCell flies directly over the victim terrestrial site, enabling on the order of approximately 50 dB of nulls in the path toward the terrestrial site, which is an exaggerated best case flight scenario.

Figure 7-A AirCell's 2003 Flight Test (reproduced from AirCell's Engineering Report)

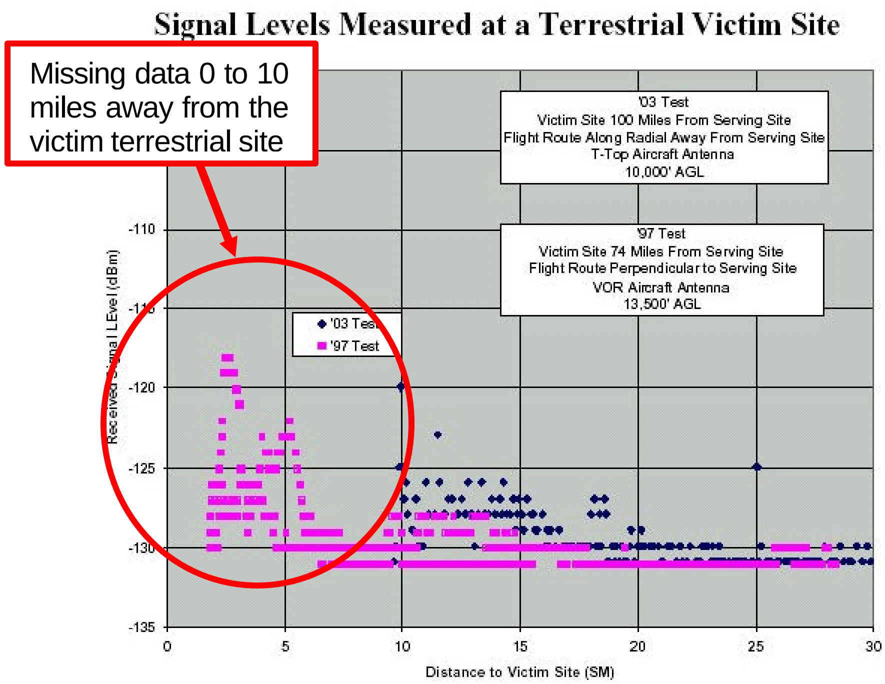

Figure 2.6.b.0

As can be seen in the figure above, AirCell's 2003 flight data is missing the most critical part of the flight test, where the AirCell equipped aircraft is within 10 miles of victim site and where the highest levels of interference from the AirCell signals would be received by the terrestrial site. AirCell states that the call dropped approximately ten miles from the victim terrestrial site that it selected for inclusion in such flight test. Again, this new data does very little to support AirCell's claim of non-interference to the terrestrial network, and only shows the 'better case' scenario of an aircraft maintaining a call greater than 10 miles from a victim site, and for only one flight path and altitude.

In addition, as observed from the figure above, the measured AirCell received signals are approximately 2-3 dB higher than what was reported in its 1997 flight data. One could extrapolate that the signals would further increase as the airplane approached the victim site, however not enough test plan information is provided by AirCell. For this new flight plan, AirCell does not provide supporting details that include 1.) the map of the area showing the terrestrial site and serving AirCell site locations & orientation to the flight route; 2.) the type, orientation, and mounting height of base station antennas that were utilized by the terrestrial sites and AirCell site; 3.) the DPC power levels that were achieved for this flight test; and 4.) the DPC power box and maximum allowed power level settings that AirCell specifically configured for this AirCell serving site. Also, it is noteworthy that AirCell is attempting to compare these two flight data sets with possibly very different test parameters. One flight was at 13,500 feet, one at 10,000 feet; one flight was 74 miles from its serving site, one was 100 miles; these two tests may have had very different terrestrial site antennas, orientations, etc. With quite different test parameters, AirCell cannot compare the results of one flight test with its VOR antenna to a very different test using its belly-mounted antenna.

AirCell's flight test in 1998 attempts to provide additional aircraft orientations to the record that were missing from its 1997 flight test filing. AirCell attempts to show that this single flight plan (orientation and altitude) exhibits similar measured signal levels at a terrestrial victim site.[51] With this new data, AirCell again does not provide enough details of the flight test to evaluate such data.[52] Missing are details of the aircraft antenna type used for this test, the base site antenna orientation & type, AirCell DPC & maximum power settings, and the actual signal levels that occurred during tests.[53] Without this information, it is difficult to assess the validity of AirCell's claims for this flight. Also, it should be observed that this new flight is only performed at a single altitude of 15,000 feet, and does not get any closer than 25 miles from the victim terrestrial site on the arc pattern. At lower altitudes and at closer distances when the aircraft is parallel to the victim site are the areas of concern, where the aircraft is significantly more likely to cause higher signal levels to be received by the victim terrestrial site. With this new flight data, AirCell is once again attempting to show a 'better case' flight path scenario, as compared to other less favorable flight paths that show higher received AirCell signals by the terrestrial network.

Therefore, these two new flights consisting of two calls over a distance of about 150 miles with little supportive data hardly qualify as test data that supports AirCell's claim of re-affirming the results of the 1997 flight tests. AirCell has previously stated in the record that when the aircraft is within 10 miles of a victim site and at lower aircraft altitudes, the highest AirCell signals would be received at the terrestrial sites, but these situations are selectively excluded from AirCell's flight data.[54]

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[51] AirCell provides the results of this flight test in Figure 2.6.b.2 of AirCell's engineering review document.

[52] It is difficult to come to any conclusions about the tests that were performed in 1998 as AirCell has selectively provided excerpts from the independent engineering firm's report instead of supplying the whole report for public comment. For example, the DPC levels in this test are characterized as "its highest system defined aircraft transmit power", which is completely dependent upon the parameters that were set up in the AirCell system, none of which have been shared in its Reply Comments.

[53] AirCell does not provide the actual signal measurements; it only provides signal levels in two ranges, either a 20 dB range from –136 to –117, or a 10 dB range within –116 to –107. It should be noted that V-COMM provided actual signal level data points within signal strength increments of 1 dB for analysis.

[54] In AirCell's 2003 flight data, no measurements are provided when the aircraft is within 10 miles of a victim terrestrial site. In its 1998 flight data, when an aircraft is parallel to a victim terrestrial site, no measurements are included when the aircraft is less than 25 miles from a victim site, or at altitudes lower than 15,000 feet. These two flights offer very limited data, and are not well documented. These two new flights do not address the significant deficiencies documented within V-COMM's "Engineering Response to AirCell's Petition for Waiver Extension".

AirCell Assertion

3. Statistical analysis of the new flight test data re-affirms the 1997 test results.

After this small amount of flight data is collected as outlined above, AirCell takes the raw data from these flights and applies the same statistical probability "calculations" as it performed for its 1997 flight tests. As V-COMM has stated in previous submissions to the Commission,[55] AirCell's statistical probability analysis is not valid for a variety of reasons including that it relies upon arbitrary assumptions and invalid test data.

AirCell continues to rely upon a flawed statistical model that artificially reduces the chance of harmful interference to statistically zero, with inappropriate assumptions and comparisons to inappropriate sample sizes. For example, AirCell divides their 'impact' by the area of the continental US (3,787,319 square miles), and other inappropriate factors to significantly dilute the actual impact of its test results. In addition, AirCell uses the outcome of its 'best case' flight tests and cross interference tests with invalid test parameters as inputs to its probability analysis. Consequently, any conclusions drawn from these analyses are not valid.

7.1 Terrestrial Site Operating Noise Floor Levels

Within its Engineering Report, AirCell provides new data representing the operating noise floors occurring at three terrestrial cell sites. AirCell provides this new data in attempts to support the noise floor levels it injected in its cross interference tests with TDMA and CDMA technology, however this new data does not support this conclusion.

In one test, AirCell's measured noise plus interference data at the terrestrial site (per their Figure 2.6.b.3, reproduced below) has a mean operating noise floor of -126.9 dBm, with a standard deviation of 2.66 dB. This noise floor level is not consistent with the noise level injected in AirCell's TDMA cross-interference test, as referenced on the figure below. For the suburban site category AirCell uses the –115 dBm level as the operating cell site noise floor level. This level is clearly many dB more than the mean, standard deviation or even the 90th percentile. We once again have to question, with this growing evidence in the record, why AirCell continues to utilize a noise floor level many dB higher than their own data indicates, and significantly higher noise levels than observed in V-COMM's AMPS Noise Floor Study.

[55] Within V-COMM's report entitled "Engineering Response to AirCell's Petition for Waiver Extension", in section 5, beginning at Page 32.

Figure 7-B AirCell's Madill Site Noise + Interference (reproduced from AirCell's Engineering Report)

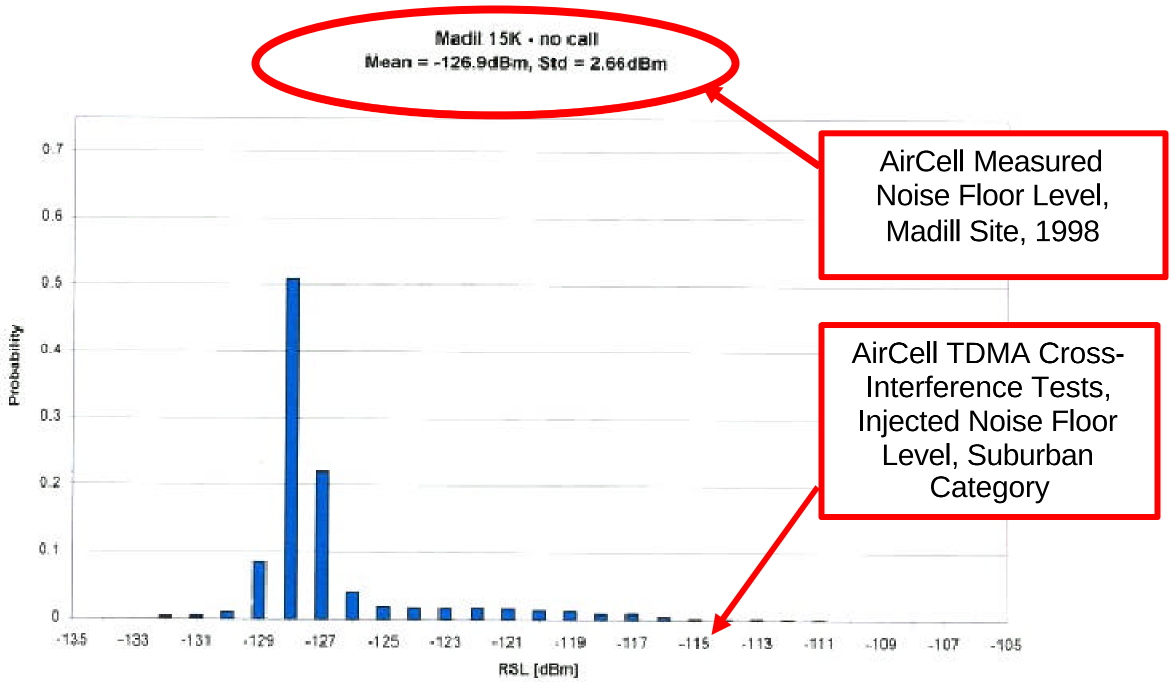


Figure 2.6.b.3 Madill Noise plus Interference, No AirCell Activity

In addition, AirCell provides another example of the operating noise floor levels that exist at the Tulsa terrestrial cell site. Within its Engineering Report, AirCell's shows the "Tulsa TDMA Noise plus Interference Measurement" with a mean noise plus Interference of –124 dBm with a standard deviation of 1.7 dB. [56] (From AirCell's noise chart, it appears the maximum received noise plus interference level is at -116 dBm.) AirCell does not choose the mean or even the 90th percentile value from this graph as the noise floor to inject into its TDMA technology cross interference tests. Instead AirCell chooses the –115 dBm, which is 1 dB higher than *any* received level from their data. This is simply not valid from an engineering and statistical standpoint. As of the time that this report had been written, AirCell has yet to explain why it continues to use noise floor levels that are not supported by their own data.

Clearly, however, higher noise floor values injected in its cross interference tests mask the levels of AirCell's signals, biasing test results favorably to AirCell's advantage. Therefore, the conclusions of AirCell's cross interference tests with TDMA technology are entirely invalid. AirCell also utilizes many other inappropriate parameters for these

[56] Within the report entitled "AirCell Engineering Review of the V-Comm Reports" Pg. 2.6-20, Figure 2.6.c.3. AirCell's figure is reproduced below.

tests as stated within V-COMM's report entitled "Engineering Response to AirCell's Petition for Waiver Extension", as submitted to the Commission.

Figure 7-C AirCell's Tulsa Site Noise + Interference (Reproduced from AirCell's Engineering Report)

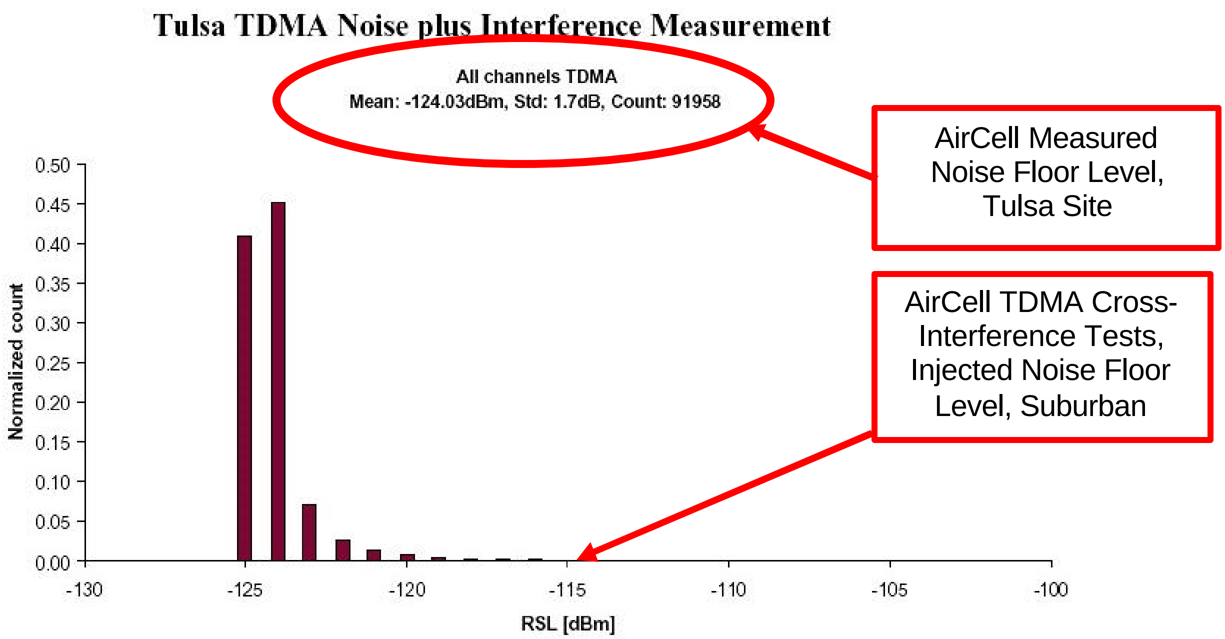


Figure 2.6.c.2

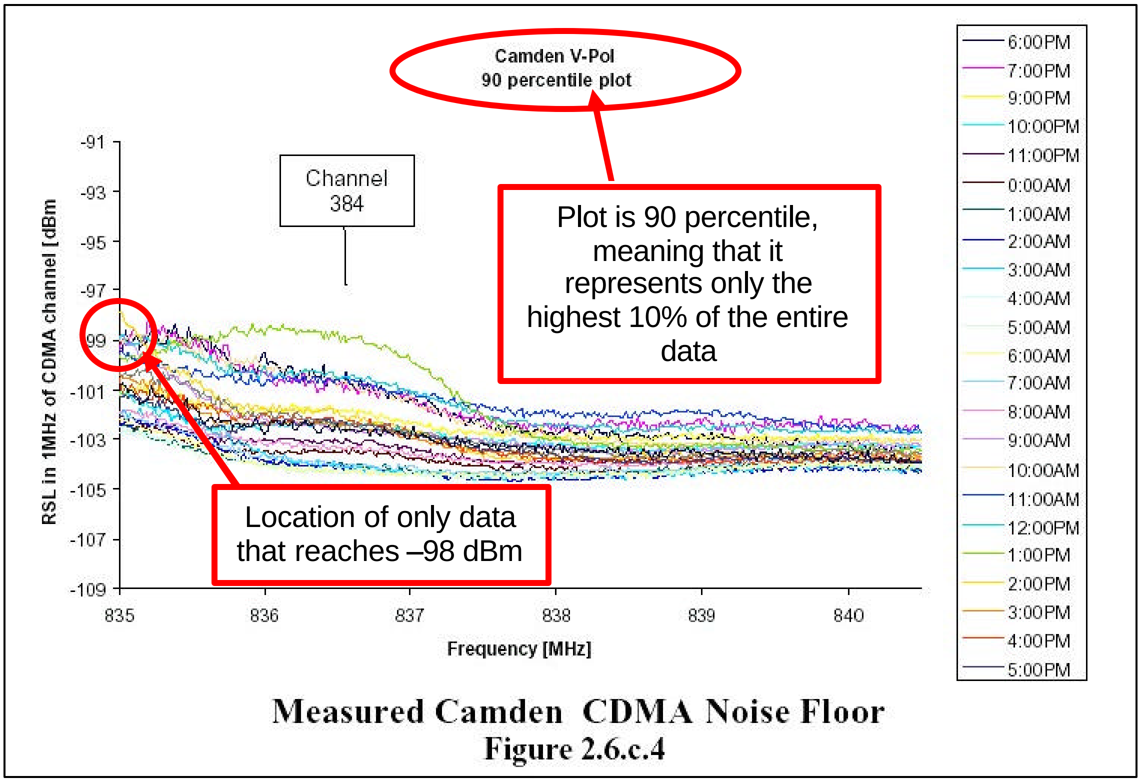
In support of the noise level that was injected in its cross interference tests with CDMA technology, AirCell presents a new data chart (Figure 2.6.c.4 within its Engineering Report, which is also reproduced below) [57] from a study conducted at a Camden, NJ site in May of 2003. This chart presents the measurement data in a misleading light. The chart does not show the actual measurements as they exist, but only shows the 90th percentile noise floor of the terrestrial CDMA site. Each line on the chart is the "90 percentile" value. This means that it represents only the highest 10% of the data recorded for that hour which is of course, 1/24th of a day. This means that each single line represents only 0.1 x 1/24, or 0.42 % of the entire data set for the entire day, and the actual operating noise floor level at the CDMA site is lower than this level 99.6% of the time.

As stated in their Engineering Report, AirCell utilizes the –98 dBm level as the noise floor level of a CDMA suburban site, and injects this level in its cross interference

[57] It should be noted that AirCell's chart is not a histogram showing the distribution of measurements over time, but is a frequency vs. signal strength chart.

tests.[58] Observe that only **one** data line (0.42% of the data) appears to reach the –98 dBm level, and this was at a frequency that is using AMPS technology and not CDMA technology. The vast majority of the 90th percentile data is between –100 to –105 dBm. The average and median noise floor levels can be expected to be much lower than the –100 dBm level. Clearly, using this chart to justify a –98 dBm noise level that AirCell used in their CDMA cross interference tests is misleading.

Figure 7-D AirCell's Camden Site Noise + Interference (Reproduced from AirCell's Engineering Report)



58 "AirCell Engineering Review of V-Comm Reports", Pg. 2.6-24. For this noise floor measurement, AirCell does not indicate the bandwidth of their measurement receiver, whether bandwidth to power conversions were utilized in the post-processing of this data, and whether these receivers were properly isolated from the stronger base station signals from any collocated carriers on this site. For some measurements, AirCell indicated that its test equipment induced interference from stronger nearby cellular carriers or intermodulation products thereof, which throws into question the integrity of their signal and noise measurements. Also, it should be noted that these noise floor levels are not the actual levels that are received at the terrestrial Camden site, but represent AirCell's test antennas, orientation, splitters & pre-amplifier setup, elevated to a similar antenna height above ground.

7.2 AirCell's Review of Other Digital Technologies

AirCell continues to state that "*AirCell poses no threat of Harmful Interference to new digital technologies,*"[59] without offering any sound technical reasoning or experimental evidence for proof. What AirCell offers in support of this assertion is that "*the results [of AirCell's existing tests] are now available as tools for characterizing new systems*."

We find it difficult to believe that AirCell, utilizing the data from its current body of flawed interference tests and insufficient flight tests in the public record, can now extrapolate *without testing any new hardware* the potential for harmful interference to any new future technology or air interface. Why has AirCell not performed such extrapolated tests on currently deployed technologies such as 1XRTT, GSM and EDGE, and submitted them to the Commission.

It is expected that the future technologies will be deployed by the cellular carriers to meet the increased demand for communications capacity. Key issues that need to be considered when assessing the impact of AirCell's Interference to these future technologies and their air interfaces are:

- Understanding that increased modulation density and complexity are deployed to enhance coverage, capacity, data throughput, and quality of service for terrestrial networks, and not as protection against external system interference.[60] Also, these new technologies utilize tighter and more advanced system operating controls to maintain service at signal levels closer to the noise floor level, which requires a greater need to maintain the margin between the interference level and the intended signal. Any additional interference from external systems adds to the operating noise level of the terrestrial networks and can cause harmful interference.

- Understanding that each air interface is deployed or will be deployed in the future has its own unique characteristics, and responses to interference must be individually tested for impact.

- Understanding that in data transmissions, packet retries in a RF channel due to external system interference affects the channel by reducing the overall capacity, throughput and latency of service provided to the end user.

[59] AirCell Engineering Review of the V-Comm Reports, Pg. 2.6-37.

[60] AirCell has made similar statements in its Petition for Waiver Extension, and continues to overlook the fact that the newer technologies operate closer to the noise floor level and are more sensitive to external interference. If AirCell's signals interfere with these newer systems, they would not provide the benefits intended by upgrading to these newer technologies. The newer technologies are not deployed as a margin to mitigate interference from secondary uses of cellular spectrum. They are deployed to enhance the coverage, capacity, data throughput and quality of service for the terrestrial cellular networks and its subscribers.

- Understanding that in frequency hopping networks, such as GSM networks, the co-channel interference does not disappear; it is spread over an even larger number of subscribers. And, when service providers deploy frequency hopping, the operating carrier to interference level drops to a minimum and thereby is very sensitive to any increase in the operating noise floor from external system interference.

- Understanding that wider bandwidth CDMA systems (i.e. UMTS or WCDMA with 5 MHz carriers) have increased processing gains as compared to narrower bandwidth 1.25 MHz CDMA systems, and have effective noise floors that will be actually lower than existing systems with advances in technology.

Without providing significant scientific analyses or performing empirical studies with these newer digital technologies, AirCell concludes that these "new digital services are even less susceptible to narrow-band co-channel interference", and that "AirCell poses no threat of harmful interference to new digital technologies and services operating in the cellular bands."[61] As provided in V-COMM's engineering report "Engineering Response to AirCell's Petition for Waiver Extension", such newer technologies can be more sensitive to AirCell signal levels, and comprehensive empirical studies with these technologies are required to assess its compatibility with the terrestrial networks.

[61] "AirCell Engineering Review of the V-Comm Reports", Pg. 2.6-37.

8 AirCell's Comments Relating to Lucent Technologies

Within its Reply and Engineering Report,[62] AirCell raised several issues in regards to the consultation provided by Lucent Technologies (the manufacturer of base station equipment utilized in V-COMM's tests), and the Comments of Lucent Technologies ("Lucent's Comments") submitted to Commission regarding the V-COMM tests (filed on 4/10/03). These assertions by AirCell are inaccurate statements characterizing Lucent's supportive role in the testing.

In an attempt to discredit the comments of Lucent Technologies, AirCell characterizes Lucent's Comments as "carefully-worded comments are hardly a ringing endorsement for V-Comm's testing, and when read carefully, actually support AirCell/WSE's analysis on a number of points."[63] However, AirCell misinterprets and provided a completely false characterization of Lucent's Comments, as explained below. In addition, Lucent Technologies also responds to these issues in its "Ex Parte Further Comments of Lucent Technologies, Inc." statement (Lucent's Further Comments), as submitted to the Commission on 10/9/03.

AirCell's assertions in its Reply document regarding the supportive role and comments of Lucent Technologies are provided below:

AirCell Assertion

1. Some of Lucent's comments simply state what Lucent advised V-Comm to do, without stating whether V-Comm followed the advice. For example, the Engineering Review points to advisory statements in Lucent's section 3.2 that suggest Lucent recognized V-Comm's errors resulting from insufficient sampling. Lucent does not comment regarding V-Comm's compliance with its guidance.

AirCell is somehow trying to suggest that V-COMM did not follow the guidance provided by Lucent Technologies. This is not correct, as V-COMM followed Lucent's advice for all test activities and post processing of data. Lucent Technologies provided valuable insight to the testing conducted by V-COMM, as Lucent is the manufacturer of the base station equipment utilized in the tests. Also, it should be noted that AirCell's statement that "Lucent recognized V-Comm's errors resulting from insufficient sampling" is completely false and is manufactured solely by AirCell. Lucent suggested using trend lines along with the measurement data to increase the statistical significance of the results, which adds confidence to the results of the Phase 2 interference tests. AirCell's suggestion is completely false and manufactured simply by AirCell.

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[62] AirCell addressed issues concerning Lucent Technologies in section 3.2 of its engineering report attachment, and in section D of its "Reply Comments of AirCell, Inc" document.

[63] AirCell Reply document, Section D, page 62.

AirCell Assertion

2. In describing the tests, Lucent acknowledges the limitation of its equipment, admitting that "some equipment did not measure readings below –120 dBm. It is likely that these reading [sic] indicate interference levels below –120 dBm." Based on this statement, V-Comm has no legitimate basis for reporting noise floor measurements in the –120 to –130 dBm range.

In this assertion, AirCell has taken Lucent's statements out of correct context. AirCell quoted a statement from footnote 5 of Lucent's Comments, in which Lucent clearly references this comment in relation to the "Key results from flight path testing". AirCell takes this statement completely out of context, and mistakenly uses it to support its position regarding the noise floor measurements conducted in the AMPS Noise Floor Study. Hence, AirCell's assertion can be dismissed as moot.

AirCell Assertion

3. Lucent specifically notes that "[t]ypically, the specified (warranted) noise floor is –124 dBm/30kHz." V-Comm ignores this guidance and presents data extrapolated beyond the valid linear capability of the test equipment.

Similar to the previous assertion, AirCell has also taken this Lucent statement out of correct context. The Lucent statement refers to the base station equipment's "guaranteed" or "warranted" noise floor.[64] The actual or "typical" noise floor level is lower than the Lucent "warranted" noise floor of –124 dBm, which can be expected. The actual performance of cell site equipment would naturally exceed the manufacturer's guaranteed minimum performance specifications.[65] AirCell misinterprets Lucent's statement that refers to the cell site's "warranted" performance, which is *not* the same as the cell site's actual or "typical" performance.

Also, it should be noted that AirCell is being disingenuous with this claim. AirCell knows that the Lucent AMPS cell equipment noise floor is less than –124 dBm, as it configures its Ellendale, DE site with a target DPC setting of –121 dBm and the lower end of its power box at -124 dBm (referenced to cell input). AirCell measures the cell site's "actual" noise floor performance and optimizes its sites accordingly. With these settings, AirCell must recognize that the actual noise floor of the cell site is –127 dBm or lower, in order for it to achieve at least 6 dB carrier to interference margin for its AMPS calls on average, and at least 3 dB for calls with signals received at the lower end of its DPC power box. If the cell site's noise floor were higher than this level, AirCell's system would not operate properly or be able to sustain quality calls.

[64] In V-COMM's AMPS Noise Floor Study report, the guaranteed minimum cell site noise figure and noise floor is also provided as a reference.

[65] Equipment vendors and wireless standards typically reference minimum performance standards and guaranteed specifications that include a sufficient margin of signal strength over and above the typical or actual performance range of the equipment.

As provided in the AMPS Noise Floor Study report, V-COMM provides the actual performance value for Lucent cell site equipment noise floor, with input provided from Lucent, which is consistent with the measurements in the study.

AirCell Assertion

4. AirCell agrees with Lucent that the total interference to consider in the C/N+I ratio is comprised of the receiver noise and co-channel interference. As discussed supra in Section II.A.1, V-Comm fails to follow this guidance and instead uses receiver noise only to represent total interference.

It appears this statement is inconsistent with the statements in AirCell's Engineering Report document. The first sentence states that "AirCell agrees with Lucent that the total interference to consider in the C/N+I ratio is comprised of the receiver noise and co-channel interference." V-COMM also agrees with this statement, and the cell site noise measurements performed by V-COMM represent <u>exactly that</u>, the noise plus interference. However, AirCell's Engineering Report is not consistent with this assertion. In their Engineering Report, AirCell erroneously asserts that the noise must be removed, and the data re-cast so as to *only* reflect the highest co-channel interference levels. Apparently, AirCell should be more attentive to the consistency of its assertions in its reports submitted to the FCC.

AirCell Assertion

5. As explained in Section II.A.1.a. supra, V-Comm does not follow the Lucent documentation in processing the noise floor data taken using the PLM2 tool. The fact that Lucent chose to remain silent on this issue is a glaring omission that calls into question the credibility and thoroughness of Lucent's Comments.

This issue is thoroughly explained in an earlier section of this report (Section 3, regarding AirCell Assertion #1). AirCell has once again taken a Lucent statement out of correct context. V-COMM did follow Lucent's guidelines and received them directly from Lucent. AirCell mistakenly refers to a quote from an old AT&T manual, and uses it incorrectly.

AirCell Assertion

6. Lucent's statement that signals at –117 to –114 dBm caused degradation in the blocked call rate is meaningless without noting the received signal level of the calls being blocked.

Lucent Technologies addresses this issue in its recently filed Further Comments. Lucent provides further details relating to its previous comments, and states that the "statistically significant difference occurred for interference in the –117 to –114 dBm range".

AirCell Assertion

7. Lucent states that an external noise power of –109 dBm would result in a 30% cell coverage reduction, but misleadingly omits the very important point that this is only true when the source of interference is spread across the whole 1.25 MHz bandwidth CDMA channel. This calculation does not apply to narrow-band 30 kHz interferers which, at –109 dBm would only be equivalent to a 1.25 MHz carrier at –125.2 dBm.

Lucent Technologies also addresses this issue in its Further Comments, and provides an explanation for the reason that AirCell's analyses are incorrect. As provided in Lucent's Further Comments submitted to the Commission:

> *"AirCell incorrectly interprets and inappropriately modifies these results. In summary, AirCell argues that Lucent overstates the coverage impact of a narrowband interferer because Lucent does not consider that the interferer's power would be spread over the bandwidth of the CDMA carrier. AirCell wrongly concludes that the actual impact in this scenario would be 16.1 dB more benign than that shown in the figure. AirCell is similarly mistaken in concluding that the capacity impact described by Lucent is overstated. In fact, the graphs in question already include the effect of spreading the narrowband interference power over the CDMA bandwidth. AirCell's suggested adjustment essentially applies a spreading gain twice, as opposed to once. By applying spreading gain twice, AirCell significantly underestimates the impact of narrowband interferers. This method of analysis is incorrect and could not be supported by valid measurements."*

AirCell Assertion

8. AirCell states that the Comments of Lucent Technologies do not list the contributing authors, and their comments "do more to injure Lucent's own credibility".

Lucent Technologies responds to this issue in its recently filed comments, as follows:

> *"Finally, AirCell appears to place some meaning on the fact that the authors of the study Lucent included in its Comments were not listed, stating that "the unknown author of this testimonial seems to misunderstand the concepts of CDMA spreading and despreading …."*
>
> *The correct analysis of narrowband interference has been key to Lucent's widespread successful deployment of cellular CDMA systems, which typically operate in close spectral and spatial proximity to AMPS systems. The Appendix on interference was authored by Dr. Shen-De Lin and Mr. Mark Newbury, who have played a key role in the design and implementation of Lucent wireless spread spectrum systems for over a decade. Dr. Lin is a Consulting Member of Technical Staff (CMTS), with specialty in the analysis of mutual interference between wireless systems. Mr. Newbury is a Senior Manager in Radio*

> *Technology Applications, and a Fellow of Bell Laboratories. Either would be glad to provide any further clarification that the Commission would find useful."*

It should be noted that the contributing members of Lucent include one of their Consulting Members of Technical Staff, which is Lucent's highest technical position in their company, and a senior manager who is a Fellow of Bell Laboratories. With its inherent knowledge, as the manufacturer of wireless base stations and an extensive research and design company, Lucent Technologies offers significant insight into the subjects of wireless technologies and the performance of cellular base station equipment. Lucent's credibility in these areas of discipline need not be questioned.

9 Interference Effects of Illegal Airborne Cellular Telephone Calls

Within its Reply, AirCell included a report written by Dr. John R. Doner ("Doner Report"), entitled "An Analysis of the Interference Effects of Illegal Airborne Cellular Telephone Calls".[66] Within this report, Dr. Doner states that "anyone familiar with the concepts of RF propagation would immediately recognize that illegal airborne calls using the AMPS system may interfere with the legitimate AMPS calls being made by AMPS customers." Dr. Doner's analysis offers that for areas of concentrated illegal airborne phone use activity there would be on average "740 calls per day which are seriously degraded of which 695 will be terminated."

Further, Dr. Doner concludes that "it is obvious that cellular providers can be very substantially affected by illegal airborne calls, and really have no means whatsoever to even detect this activity and thereby press action against such transgressors." V-COMM agrees with these two assessments offered by Dr. Doner. First, illegal airborne use of cellular telephones can cause very substantial interference to terrestrial cellular networks; and second, cellular providers have no means whatsoever to detect this activity. Actually, V-COMM submitted a similar statement to the Commission regarding the inability of cellular switched-based tools to detect interference from airborne AirCell phone transmissions.[67] From the statement in the Doner Report, it appears Dr. Doner agrees with V-COMM's assessment that the terrestrial cellular providers are not able to detect this type of interference from airborne transmissions. <u>The Commission should take these statements under consideration, concerning AirCell's claim that terrestrial networks have 'no reported incidents of interference.'</u>

Further, V-COMM agrees with two other interference assessments offered by Dr. Doner concerning the airborne use of an AMPS call. First, when the airborne AMPS phone terminates the call and sends the supervisory 'hangup' signal, this signal can be received by other nearby co-channel terrestrial base stations, and result in dropped calls at these cellular base stations. Second, cellular base stations that have co-channels that are *not* in-use may also be affected by airborne transmissions, when an interference detection / channel de-allocation feature is utilized at the base station, and the interference is received above the threshold set for de-allocation. V-COMM previously submitted similar statements to the FCC, however it was concerning the interference effects from airborne AirCell AMPS mobile transmissions.

[66] The report from John R. Doner is included in AirCell's Reply Comments (in Appendix B) in this proceeding, and is dated June 7, 1998.

[67] This is included in Section 9.2 ("Cellular Switch-based Interference Detection Tools Are Not A Feasible Method For Measuring Potential Interference From AirCell Transmissions") of V-COMM's "Engineering Report of the AirCell Compatibility Test". (filed on 4/10/03)

Dr. Doner neither includes a comparison of the interference effects of airborne AirCell transmissions to the illegal use of airborne cellular phones, nor provides similar analyses and assumptions to assess the interference potential of the AirCell system. It should be noted that the AirCell system operates AMPS mobiles up to a maximum power of 75 mW, which is only 9 dB less than maximum power of AMPS & TDMA cellular phones (600 mW), and only 4 dB less than the maximum power of CDMA phones (200 mW). In addition, AirCell base stations generally serve mobiles at further distances (up to 90 miles away or more from its serving AirCell site) as compared to illegally used cellular calls that are served by nearby base stations. With the increased serving distance and path loss for the AirCell mobiles, AirCell calls can operate at higher power levels than illegally used airborne cellular phones. Also, upon consideration of the mobile antenna used by both systems, the AirCell system would represent the stronger signal. The AirCell mobile antenna is equivalent to a unity gain dipole (0 dBd) antenna that is mounted on the exterior of the aircraft. In comparison, typical cellular phones operate with effective antenna gains that are approximately 2 dB less (or 0 dBi), and their signals can be further attenuated by reflections within the aircraft and passing through the window of the aircraft. Consequently, with its effective radiated power levels and line of sight propagation to the terrestrial sites, the AirCell system offers little protection compared to regular cellular phones used illegally on-board airplanes in-flight.

10 Appendix

10.1 V-COMM Background Information

V-COMM is a leading provider of quality engineering and engineering related services to the worldwide telecommunications industry. V-COMM's staff of engineers are experienced in Cellular, Personal Communications Services (PCS), Enhanced Specialized Mobile Radio (ESMR), Paging, Wireless Data, Microwave, Signaling System 7, and Local Exchange Switching Networks. Further, V-COMM was selected by the FCC & Department of Justice to provide expert analysis and testimony in the Nextwave and Pocket Communications Bankruptcy cases. V-COMM has offices in Blue Bell, PA and Cranbury, NJ and provides services to both domestic and international markets. For additional information, please visit V-COMM's web site at www.vcomm-eng.com.

Biographies of Key Individuals

Dominic C. Villecco
President and Founder
V-COMM, L.L.C.

Dominic Villecco, President and founder of V-COMM, is a pioneer in wireless telecommunications engineering, with 22 years of executive-level experience and various engineering management positions. Under his leadership, V-COMM has grown from a start-up venture in 1996 to a highly respected full-service consulting telecommunications engineering firm.

In managing V-COMM's growth, Mr. Villecco has overseen expansion of the company's portfolio of consulting services, which today include a full range of RF & Network design, engineering & support; network design tools; measurement hardware; and software services; as well as time-critical engineering-related services such as business planning, zoning hearing expert witness testimony, regulatory advisory assistance, and project management.

Before forming V-COMM, Mr. Villecco spent 10 years with Comcast Corporation, where he held management positions of increasing responsibility, his last being Vice President of Wireless Engineering for Comcast International Holdings, Inc. Focusing on the international marketplace, Mr. Villecco helped develop various technical and business requirements for directing Comcast's worldwide wireless venture utilizing current and emerging technologies (GSM, PCN, ESMR, paging, etc.).

Previously he was Vice President of Engineering and Operations for Comcast Cellular Communications, Inc. His responsibilities included overall system design, construction and operation, capital budget preparation and execution, interconnection negotiations, vendor contract negotiations, major account interface, new product implementation, and cellular market acquisition. Following Comcast's acquisition of Metrophone, Mr. Villecco successfully merged the two technical departments and managed the combined department of 140 engineers and support personnel.

Mr. Villecco served as Director of Engineering for American Cellular Network Corporation (AMCELL), where he managed all system implementation and engineering design issues. He was responsible for activating the first cellular system in the world utilizing proprietary automatic call delivery software between independent carriers in Wilmington, Delaware. He also had responsibility for filing all FCC and FAA applications for AMCELL before it was acquired by Comcast.

Prior to joining AMCELL, Mr. Villecco worked as a staff engineer at Sherman and Beverage (S&B), a broadcast consulting firm. He designed FM radio station broadcasting systems and studio-transmitter link systems, performed AM field studies and interface analysis and TV interference analysis, and helped build a sophisticated six-tower arrangement for a AM antenna phasing system. He also designed and wrote software to perform FM radio station allocations pursuant to FCC Rules Part 73.

Mr. Villecco started his career in telecommunications engineering as a wireless engineering consultant at Jubon Engineering, where he was responsible for the design of cellular systems, both domestic and international, radio paging systems, microwave radio systems, two-way radio systems, microwave multipoint distribution systems, and simulcast radio link systems, including the drafting of all FCC and FAA applications for these systems.

Mr. Villecco has a BSEE from Drexel University, in Philadelphia, and is an active member of IEEE. Mr. Villecco also serves as an active member of the Advisory Council to the Drexel University Electrical and Computer Engineering (ECE) Department.

Relevant Expert Witness Testimony Experience

Over the past five years, Mr. Villecco had been previously qualified and provided expert witness testimony in the states of New Jersey, Pennsylvania, Delaware and Michigan. Mr. Villecco has also provided expert witness testimony in the following cases:

United States Bankruptcy Court

Nextwave Personal Communications, Inc. vs. Federal Communications Commission (FCC) **

Pocket Communications, Inc. vs. Federal Communications Commission (FCC) **

** In these cases, Mr. Villecco was retained by the FCC and the Department of Justice as a technical expert on their behalf, pertaining to matters of wireless network design, optimization and operation.

David K. Stern
Vice President and Co-Founder
V-COMM, L.L.C.

David Stern, Vice President and co-founder of V-COMM, has over 20 years of hands-on operational and business experience in telecommunications engineering. He began his career with Motorola, where he developed an in-depth knowledge of wireless engineering and all the latest technologies such as CDMA, TDMA, and GSM, as well as AMPS and Nextel's iDEN.

While at V-COMM, Mr. Stern oversaw the design and implementation of several major Wireless markets in the Northeast United States, including Omnipoint - New York, Verizon Wireless, Unitel Cellular, Alabama Wireless, PCS One and Conestoga Wireless. In his position as Vice President, he has testified at a number of Zoning and Planning Boards in Pennsylvania, New Jersey and Michigan.

Prior to joining V-COMM, Mr. Stern spent seven years with Comcast Cellular Communications, Inc., where he held several engineering management positions. As Director of Strategic Projects, he was responsible for all technical aspects of Comcast's wireless data business, including implementation of the CDPD Cellular Packet Data network. He also was responsible for bringing into commercial service the Cellular Data Gateway, a circuit switched data solution.

Also, Mr. Stern was the Director of Wireless System Engineering, charged with evaluating new digital technologies, including TDMA and CDMA, for possible adoption. He represented Comcast on several industry committees pertaining to CDMA digital cellular technology and served on the Technology Committee of a wireless company on behalf of Comcast. He helped to direct Comcast's participation in the A- and B-block PCS auctions and won high praise for his recommendations regarding the company's technology deployment in the PCS markets.

At the beginning of his tenure with Comcast, Mr. Stern was Director of Engineering at Comcast, managing a staff of 40 technical personnel. He had overall responsibility for a network that included 250 cell sites, three MTSOs, four Motorola EMX-2500 switches, IS-41 connections, SS-7 interconnection to NACN, and a fiber optic and microwave "disaster-resistant" interconnect network.

Mr. Stern began his career at Motorola as a Cellular Systems Engineer, where he developed his skills in RF engineering, frequency planning, and site acquisition activities. His promotion to Program Manager-Northeast for the rapidly growing New York, New Jersey, and Philadelphia markets gave him the responsibility for coordinating all activities and communications with Motorola's cellular infrastructure customers. He directed contract preparations, equipment orders and deliveries, project implementation schedules, and engineering support services.

Mr. Stern earned a BSEE from the University of Illinois, in Urbana, and is a member of IEEE.

Sean Haynberg
Director of RF Technologies
V-COMM, L.L.C.

Sean Haynberg, Director of RF Technologies at V-COMM, has over 13 years of experience in wireless engineering. Mr. Haynberg has extensive experience in wireless system design, implementation, testing and optimization for wireless systems utilizing CDMA, TDMA, GSM, AMPS and NAMPS wireless technologies. In his career, he has conducted numerous first office applications, compatibility & interference studies, and new technology evaluations to assess, develop and integrate new technologies that meet industry and FCC guidelines. His career began with Bell Atlantic NYNEX Mobile, where he developed an in-depth knowledge of wireless engineering.

While at V-COMM, Mr. Haynberg was responsible for the performance of RF engineering team supplying total RF services to a diverse client group. Projects varied from managing a team of RF Engineers to design and implement new a PCS wireless network in the NY MTA; to the wireless system design & expansion of international markets in Brazil and Bermuda; to system performance testing and optimization for numerous markets in the north and southeast; to the development and procurement of hardware and software engineering tools; to special technology evaluations, system compatibility and interference testing. He has also developed tools and procedures to assist carriers in meeting compliance with FCC rules & regulations for RF Safety, and other FCC regulatory issues. In addition, Mr. Haynberg was instrumental in providing leadership, technical analysis, engineering expertise, and management of a team of RF Engineers to deliver expert-level engineering analysis & reporting on behalf of the FCC & Department of Justice, in the Nextwave and Pocket Communications Bankruptcy proceedings.

Prior to joining V-COMM, Mr. Haynberg held various management and engineering positions at Bell Atlantic NYNEX Mobile (BANM). He was responsible for evaluating new technologies and providing support for the development, integration and implementation of first office applications (FOA), including CDMA, CDPD, and RF Fingerprinting Technology. Beyond this, Haynberg provided RF engineering guidelines and recommendations to the company's regional network operations, supported the deployment and integration of new wireless equipment and technologies, including indoor wireless PBX/office systems, phased/narrow-array smart antenna systems, interference and inter-modulation analysis and measurement, and cell site co-location and acceptance procedures. He was responsible for the procurement, development and support of engineering tools for RF, network and system performance engineers to enhance the system performance, network design and optimization of the regional cellular networks. He began his career as an RF Engineer responsible for the system design and expansion of over 100 cell sites for the cellular markets in New Jersey, Philadelphia, PA; Pittsburgh, PA; Washington, DC; and Baltimore, MD market areas.

Mr. Haynberg earned a Bachelor of Science degree in Electrical Engineering with high honors, and attended post-graduate work, at Rutgers University in Piscataway, New Jersey. While at Rutgers, Mr. Haynberg received numerous honors including membership in the National Engineering Honor Societies Tau Beta Pi and Eta Kappa Nu. In addition, Mr. Haynberg has been qualified, and provided expert witness testimony in the subject matter of RF engineering and the operation of wireless network systems for many municipalities in the state of New Jersey.

10.2 Cingular's Response to AirCell's Criticisms of Cingular

The following three pages of this report were provided by Cingular Wireless. These statements address and respond to AirCell's criticisms directed to Cingular Wireless.

The third page contains a drawing that was provided by an independent contractor to show the AirCell base site antennas at the Marlboro tower site. This figure clearly shows the AirCell receive antennas mounted upright on tower mounting arms, and not inverted as indicated in AirCell's photograph provided in its Reply Comments. Thus, the AirCell receive antennas were not obstructed by the tree line at the Marlboro site. And, AirCell's assertion that one of its receive diversity antennas was obstructed and caused higher signal levels induced in the V-COMM flight tests is not an accurate statement.

Cingular Wireless addresses other inaccurate statements made by AirCell, in their response provided below.

September, 22, 2003

Cingular has discussed the criticisms of Cingular raised by AirCell in their "AirCell Engineering Review of V-Comm Reports" document with the appropriate personnel in our Philadelphia market.

The following is a summary of the responses given during a conference call. These are referenced to the specific sections in the above captioned report.

Section 2.3-6 regarding the set up of handoffs between Ellendale and Marlboro II

> The market can set it up as long as there are IS41 links to the switches controlling the cell sites. In the case of Marlboro to Ellendale, this can be done. Cingular/SBC had some early discussions with AirCell in which AirCell had agreed to pay for the inter-machine links if they wanted the handoff capability. AirCell never came back and requested that it be set up, consequently there are no inter-machine handoffs set up on the Cingular network for AirCell.

Sections 2.3-19 Footnote #7 and 2.3-29 Footnote #13 regarding the setting of switch parameters and the dissemination of switch information requested by AirCell.

> Switch settings requested by AirCell were loaded into the switch the only changes that were made were done to facilitate the "DPC off" flight-testing. The changes were put in place for the duration of the flight tests and then they were returned to the settings requested by AirCell. It was during one of these reloads that "DPC power boost" was inadvertently activated.
>
> AirCell has, both during the V-Comm testing and afterwards, asked for switch data and Cingular has provided it. Mostly, AirCell has requested traffic related data but they have asked for switch settings. There were some times when our server was down when we could not provide the information requested.

Section 2.3-19 regarding the disconnection of the CSTU

> Per our Contract, Cingular monitors and maintains the Lucent radio equipment and RF antennas for AirCell. Any other ancillary equipment is maintained by AirCell. As such, Cingular does not maintain this piece of equipment. However, based on this point being raised by AirCell in their filing, Cingular had our Field Engineer go to the site to see if it is still plugged into the power. When he arrived at Marlboro he noticed that the power supply was powered up but the phone appeared to have no power. A quick check of the power lead connections revealed that the wires were not making connection. When he

loosened and re-tightened these connections the phone powered up. Cingular does not have visibility to determine whether the CTSU is operating properly.

Section 2.3-19 regarding the location of AirCell's antennas on the Marlboro tower.

Cingular had our contractor, Varitech, do a drop measurement for both sets of antennas to determine the current height. The contractor also recorded the antenna make/model numbers of each of the 4 antennas. He also took a sighting of the surrounding tree line at the height of the (Rad. center) of the lower inverted dipole. See the attached vertical tower profile for antenna information. The antenna boom heights for the lower set of antennas were confirmed at 50 feet AGL and at 65 feet AGL for the upper set of antennas as originally agreed to by Mr. Wes Burnett of AirCell in February 2001. As can be seen from the attached tower profile, the 2 receive antennas are the upward (vertical) mounted antennas which are not obstructed by the tree line.

Section 2.3-32 regarding violation of FCC waiver.

Cingular was, during the Flight testing performed by V-Comm, and is today operating under the terms of the waiver. The waiver has two major technical guidelines; 1) it states the maximum transmitter power shall not exceed 75 milliwatts and 2) it states that AirCell's service shall not interfere with the primary user. This power limit was not exceeded at any time during the DPC disabled testing. Further Cingular coordinated the testing with the other cellular operators in the area of the flight paths and cleared the channel that was used for testing. This guaranteed that there would be no interference into or from other operating systems. There is no need for Cingular to have an experimental license to operate and test a FCC authorized service.

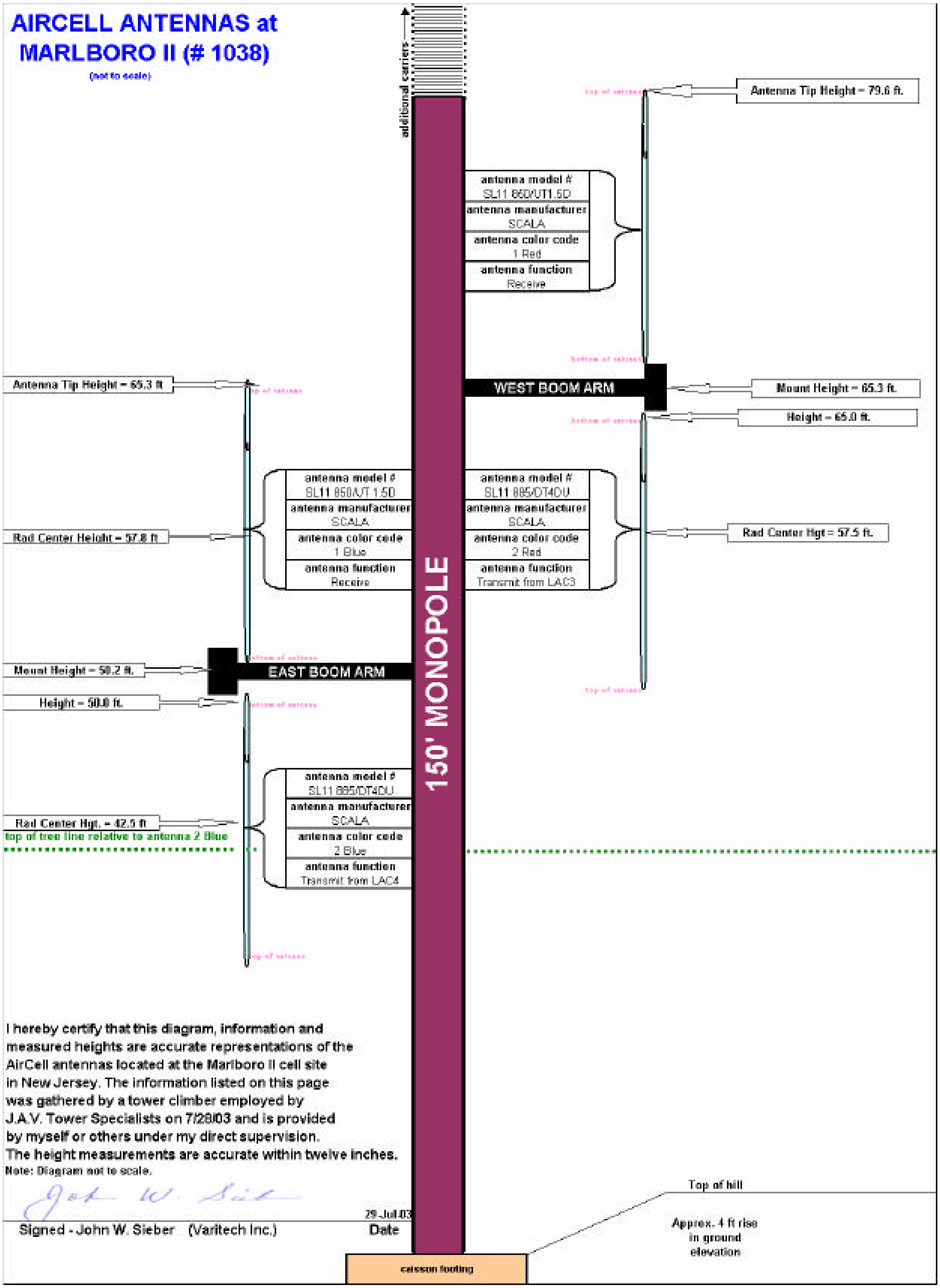
These statements are based on notes taken at the time of the testing in late 2000 and early 2001 and are correct to the best of our knowledge. This information has been shared with V-Comm to help them respond to the captioned document.

Sincerely,

Les Wilding

Les Wilding
Sr. Manager
HQ, RF Engineering and Support.

Attachment: Marlboro NJ, Vertical Tower Profile



I hereby certify that this diagram, information and measured heights are accurate representations of the AirCell antennas located at the Marlboro II cell site in New Jersey. The information listed on this page was gathered by a tower climber employed by J.A.V. Tower Specialists on 7/28/03 and is provided by myself or others under my direct supervision. The height measurements are accurate within twelve inches.

Note: Diagram not to scale.

John W. Sieber

Signed - John W. Sieber (Varitech Inc.) 29-Jul-03 Date

10.3 Case Study Flight Profile and Affected Terrestrial Cell Sites

Figure 10-A Flight Profile & Affected Terrestrial Sites, Slant-45 Polarized Terrestrial Antenna

Jet Aircraft Flight Profile & Affected Terrestrial Cell Sites, Average Signal
SL45 Antenna, Washington Dulles to Teterboro, NJ Airport